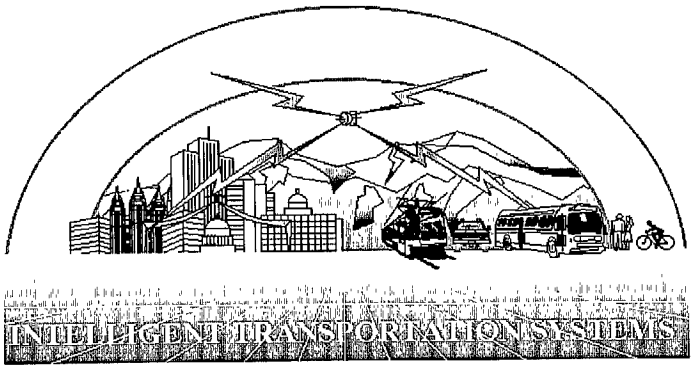
EXECUTIVE SUMMARY



EARLY DEPLOYMENT PLANNING STUDY

ITS
Strategic Deployment Plan

Prepared for:

UDOT
GOING THE EXTRA MILE
Utah Department of Transportation

Prepared by:

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JK & Associates

February 1997

660663-02600

Intelligent Transportation Systems

DOT/FHWA
101564

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INTRODUCTION

The Salt Lake Valley ITS Early Deployment Planning Study-Phase II prepared the framework to deploy candidate Intelligent Transportation System (ITS) projects that address Salt Lake Valley's transportation needs. A planning process was used that included redefining the User Services into market packages, mapping market packages to functional areas and requirements; and assigning an architecture structure that fulfills the goals and objectives for Phase I (User Service Plan) of this study.

Project sets were developed based on this process and needs that were determined by the ITS Task Force. The Task Force includes representatives from agencies and jurisdictions from the Salt Lake Valley area. Time-frames for project deployment were assigned based on the nature of the transportation conditions over the next fifteen years. Projects to be deployed within the next year (early action time-frame) consider transportation issues involving I- 15 reconstruction. Five year (short-term time-frame) consider issues regarding implementation of the north/south light rail transit system and the 2002 Winter Olympic Games.

Figure 1 illustrates how the early deployment planning process has been carried out, leading to the development of this Strategic Deployment Plan. This process followed guidelines developed by FHWA for performing Early Deployment Studies. Full documentation is contained in the main report (not the Executive Summary).

Functional Requirement. Market packages, defined by the National Program Plan, matched to the corresponding User Services (developed in Phase I), were mapped to functional areas and elements. Functional areas provide technical solutions to the types of functional requirements needed to address problem areas previously identified.

System Architecture. An architecture analysis process, compatible with the FHWA's Intelligent Transportation Infrastructure (ITI) initiative identified institutional elements, implementation considerations and key issues in ITS deployment and operations. The logical architecture, including activities related to the Salt Lake Advanced Traffic Management System (ATMS), was defined. The physical architecture is further evaluated to identify alternative implementation and technologies.

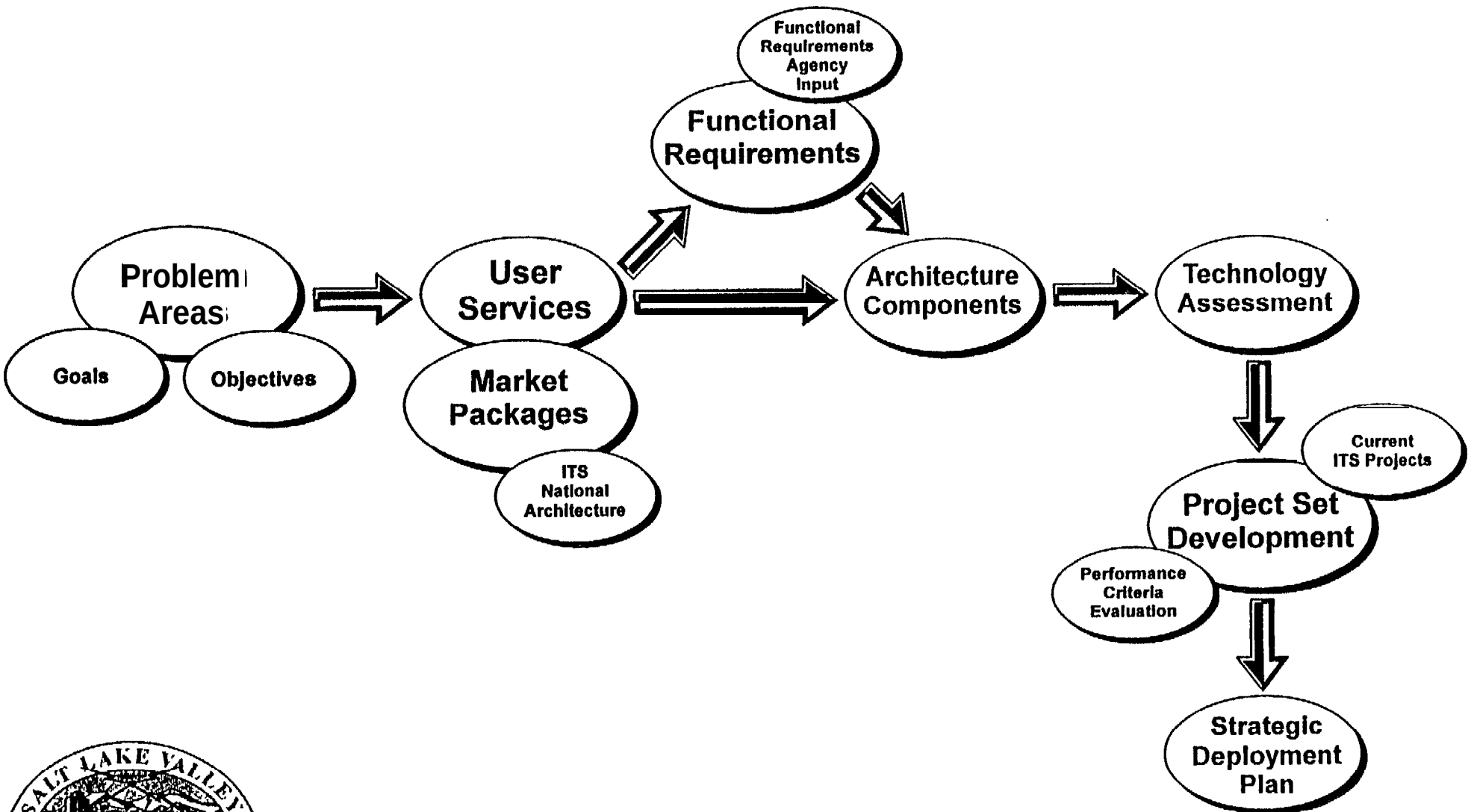
Technology Assessment. The section identified various technologies as well as relevant issues associated with the various service areas and how they may be applied to the Salt Lake Valley area.

Strategic Actions. This section summarizes specific actions and assigns them to individuals. The goal of these actions is to implement the ITS Project Sets.

Current ITS Projects. This table summarizes projects currently being implemented throughout the Salt Lake Valley. The project listings will be continually updated and made available to UDOT and Agency employees through the Intcmct. The types of technologies used, agencies implementing the project, and project contact individuals are listed.

Project Sets . Three sets of projects were developed for the following periods: Early Action (O-l years), Short-Term (l-5 years) and Long Term (5-10 years). The periods were devised to coincide the with the two major events affecting transportation in the Salt Lake Valley, reconstruction of I- 15 and the 2002 Winter Olympics. Utilizing the Early Deployment Process, an initial set of projects was developed. From this set, input was obtained extensively through group and one-on-one meeting with members of the ITS Task Force and Region 2 staff.

ITS Project Development Process
Figure 1



STRATEGIC ACTIONS

The overall goal of these strategic actions is to implement the ITS Plan projects. The three areas of key importance are coordination, staffing and training. Coordination efforts are phrased as goals and distinct action items. Persons responsible and assisting are shown.

Coordination

ITS Strategic Plan

Goal: Maintain an active, user-friendly ITS Strategic Plan.

Actions:
- -- Update ITS Strategic Plan every two years.
  Next update occurs December 1998.
- – Revise by December in order to give to Region Director and Executive Staff for use in January STIP Planning sessions.

Responsible: Congestion Management Engineer
Assisting: ITS Task Force Members, Executive Staff, Region Director

Goal: Promote ownership in the ITS Strategic Plan.

Actions:
- - Assign a champion to promote each project.
- - Consider removing project from ITS Plan if no champion exists.

Responsible: ITS Task Force Chair

ITS Task Force

Goal: Maintain a UDOT sponsored, inter-agency body responsible for implementing the ITS Plan.

Actions:
- - Formalize ITS Task Force which includes 14 voting members and advisory members consisting of all involved agencies and jurisdictions.
- ✔ Alternate Task Force Chair between Program Development (Division of Planning) and Operations (Division of Traffic and Safety).
- ✔ Hold monthly Task Force meetings to review and plan ITS project implementation.
- ✔ Hold monthly or quarterly meetings with Task Force Chair and Assistant Director of UDOT to review ITS project set implementation progress.
- - Develop and adopt Strategic ITS Plan every two years.

Responsible: Current ITS Task Force Chair
Assisting: ITS Engineer, Engineer for Program Development, Engineer for Operations, UDOT Assistant Director

See Appendix: ITS Task Force Members

ITS Related Projects

Goal: Coordinate all ITS Projects to achieve maximum benefit.

Actions:

- Adopt Official ITS Project Review Form. *See Appendix - ITS Project Review Form*
- Develop UDOT Policy which requires all ITS related projects to complete ITS Project Review Form.

Responsible: ITS Engineer
Assisting: Operations Engineer (sponsor policy for Commission Approval), ITS Task Force (officially adopt)

Goal: Monitor progress of current ITS projects and implementation of the ITS Plan.

Actions:

- Maintain and update Current *Project List* database on Internet.
- Maintain Status matrix of ITS Strategic Plan Projects.

Responsible: Research Engineer, ITS Task Force Chair

Interagency

Goal: Assure ITS Task Force communicates with key existing transportation committees.

Actions:

- ITS Task Force assigns members to attend and report activities related to the implementation of the ITS Plan.

Key committees:

Salt Lake Area Transportation Study (SLATS)
Ogden Area Transportation Study (OATS)
Utah Valley Area Transportation Study (UVATS)
Traffic Management (Signal Coordination) Committee
Incident Management Committee
Utah Transportation Research Advisory Committee (UTRAC)

Responsible: As assigned by ITS Task Force

Wasatch Front Regional Council (WFRC)/Metropolitan Planning Organization

Goal: Coordinate ITS projects during TIP development.

Actions:

- Review proposed ITS projects with planners and legislators.
- Attend seminars and courses for ITS planning and technologies.
- Attend ITS task force.

Responsible: WFRC ITS Task Force Member

State Transportation Improvement Plan (STIP) Inclusion

Goal: Include ITS Projects during STIP Development.

Actions:
- Coordinate with Programming Engineer to include ITS Projects into STIP.
- Where STIP funding is desired, assign a project champion to attend SLATS, OATS or UVATS meetings.
- Consider modification of STIP Projects to include ITS Projects.
- Include ITS Engineer on Concept Team as part of 08- 1 Design Procedure #O1C.

Responsible: ITS Engineer, Congestion Management Engineer

National-ITS-Efforts

Goal: Develop Utah ITS system compatible with National Architecture.

Actions:
- ITS Engineer review National Architecture Standards.
- ITS Engineers participate on AASHTO Technology Committees.
- CVO Coordinator continue involvement in Western States Regional activities.
- Become active in ITS Rocky Mountain.
- Join ITS America (obtain membership through ITS Rocky Mountain for cost savings).

Responsible: Task Force Chair, ITS Engineer, Motor Carrier

Outreach for ITS

Goal: Education of ITS Technologies

Actions: Educate UDOT Internal Staff

- Update and train UDOT employees for projects involving ITS technologies (projects implemented in Utah as well as nationwide).
- Conduct monthly "brown bag" technology sessions for current ITS projects. (i.e., ATMS, Video Surveillance, Avalanche Sensors).
- Include "Star Wars" technology section in *Fastlane* that would include information on existing and planned ITS Projects.
- Include a session on current ITS Projects in annual UDOT Engineers Conference.

Responsible: Community Relations, Assignments as made by ITS Task Force Chair

Goal: Promote ITS Projects Statewide

- Develop Statewide ITS Plan.
- Expand ITS Task Force Statewide.

Responsible: ITS Engineer, Congestion Management Engineer

Outreach of ITS (continued)

Actions: Educate Public on ITS

- Conduct meetings for media to obtain current and planned transportation improvements and traffic information.

Responsible: Community Relations

Actions: Educate Legislators on ITS

- Yearly tour with UDOT and Utah Legislators of current ITS projects and review for future projects.

Actions: Educate Local Elected Officials on ITS

- Conduct tour of ITS technologies with Council of Government members.

Responsible: ITS Task Force Chair
Assisting: WFRC, Community Relations

Funding

Goal: Obtain funding for ITS Projects

Actions:

- Review Federal Research, Safety, ITS, and other sources for potential funding.
- Contact potential private partners.

Responsible: Project Champions (see staffing for specific funding source review responsibility)

Utilization of Existing Resources

Goal: Integrate existing and traditional traffic data collection into ITS program.

Actions:

- Data Collection Unit assumes responsibility for data flow from Interim TOC onto Web site.
- Review ITS projects for method of data collection; utilize shared data where feasible.
- Include Data Collection Unit as voting member on ITS Task Force.

Responsible Person: Information Analyst (Program Development)

Staffing Requirements

The ITS Projects listed in the Strategic Plan have been reviewed for staffing needs. Projects will likely be designed, installed and built by either the vendor, private contractor or consultants. Several will be installed in-house, as noted on the project set. The majority of these projects will be maintained and operated by staff at the TOC, Several projects will be operated by other UDOT Divisions such as Maintenance and ISS. These are listed under existing staff responsibilities. Where anticipated, new staff is identified.

The following are recommendations for staffing. (New UDOT staffing shown in **bold).**

Traffic Operations Center (TOC)

Six new positions will be required for initial operation of the TOC.

Immediate Needs (minimum)

- **4 ATMS operators** (2 operators per shift - 6:00 a.m. to 2:00 p.m., 2:00 p.m. to 10:00 p.m.)
- Integration specialists (part of Systems Integrations Contract)
- **Equipment technician** (computer, network specialist)
- Software engineer (computer programmer with traffic engineering experience)
- **Receptionist**
- **1 Incident Management Driver**

Additional Needs Short Term

1 additional TOC operator for 24-hour operation (10:00 p.m. to 6:00 a.m.)
3 traffic signal maintenance personnel
3 engineers/technicians to develop signal timing plans (initially part of I- 15 contractor team)

- Full-time employee/2 half-time employees: Salt Lake City
- Full-time employee/2 half-time employees: Salt Lake County
- **4 Incident Management Drivers** (1 per 15-miles of roadway)

Equipment Requirements

2 additional bucket trucks
Additional Inspection and Maintenance Trucks

Existing Staff Responsibilities

Most of these duties are not new but address what is currently being done, or what should be done. See appendix "Task Force Attendees" for list of current personnel.

Informational System Support

- Maintain Traveler Information on UDOT Home Page.
  Provide support for LAN installation of information.
- Provide technical support or project management for programing on all non TOC ITS projects.
  Continue to provide support on CVO Projects (current staff requirement is 30 hours per week).
  Eventually will require: Dedicated ITS Computer/Network Specialists FTE's. 2 for Programming/Maintenance, 2 for Program/Consultant Management.

ITS Engineer(Division of Traffic and Safety)

Chair ITS Task Force every other year.
Coordinate all non-traffic signal projects with TOC.
Attend SLATS, OATS, UVATS meeting for ITS project inclusion.
Review funding sources for ITS projects (HES, Traffic).

- Review national ITS Architecture standards. Revise UDOT ITS projects if required.

Traffic Operations Engineer

Attend ITS Task Force.
Act as Liaison between TOC and other ITS Projects.

Congestion Management Engineer(Program Development)

Chair ITS Task Force Alternating Years.
Attend SLATS, OATS, UVATS meetings, represent ITS Plan Projects.
Coordinate with Project Champions to have selected projects incorporated into STIP process.
Update ITS Plan by December of even years.
Review funding sources for ITS projects.
Review Olympic Planning Efforts for ITS Plan Compliance.
Coordinate with Programming Engineer to include ITS Projects on STIP.

Information Analyst (Program Development Data Collection Unit)

Attend ITS Task Force.
Direct data flow from interim TOC onto Web Site.
Coordinate with TOC on data collection issues
Review proposed ITS project for data compatibility.
Review Data Statistic Publications for potential funding sources and private partners.

Maintenance Engineer-(Central Office)

Attend ITS Task Force.
Review maintenance budget for ITS project funding potential.
Direct a specific Maintenance Engineer UDOT employee to manage, develop and implement ITS technology projects.

Early Action Staffing Plan

Utilize existing staff to manage technology projects.
Utilize Avalanche Forecast Engineer to manage RWIS Project (Region 2).

Short-Term Staffing Plan

Utilize central maintenance engineer to direct Road and Weather Information Systems (RWIS) and Global Positioning Systems (GPS) coordination duties for multiple regions. **This will require a new FTE or re-assignment of existing duties.**

Long-Term (Full-time employee)

Transfer ITS functions to Regional Maintenance staff. **This will require new FTE at Region level.**

Research Engineer

Attend ITS Task Force.
Review Research grants for national funding sources.
Manage ITS research projects.
Promote studies projects that will assist in ITS plan implementation.
Coordinate implementation and integration of new ITS technologies.
Maintain *Current ITS Project List* on Internet.

Community Relations

- Attend ITS Task Force.
- Assign one person ITS public relations specialist.
- Coordinate all traffic information released to public, media.
- Reside (part-time) at TOC.
- Organize yearly technology tour for Legislators.
- Conduct public education campaigns for ITS.

Motor Carrier Director

Attend ITS Task Force.
Lead interstate alliance for traveler information.
Promote multi-state projects.

Region Level Staffing Requirements

TOC requirements are listed above. Memorandum is in Appendix of *main document* for *definition* of *Central vs. Region responsibilities.*

Region Traffic Engineer

Attend ITS Task Force.
Assign working level advocates for ITS projects.
Champion policy change for increased funds for Incident Management funded by construction projects.
- Review ITS Plan, input projects.
- Manage Incident Management Program.

Region Maintenance Engineer

Supervise employee responsible for ITS technologies (GPS and RWIS).
Review ITS Plan, input projects.
Maintain ADVISE Fog Warning System.

Region Director

Review ITS Plan and incorporate ITS Elements into STIP where feasible.

Other Agencies

Salt Lake City

Attend Task Force Meetings.
Review ITS Plan for project inclusion.
Sponsor Projects through SLATS.

Salt Lake County

- Attend Task Force Meetings.
- Review ITS Plan for project inclusion.
  Sponsor Projects through SLATS.

University of Utah

Attend ITS Task Force as an advisory member.
Assist in developing private partnerships with UDOT to implement ITS projects.
- Assist and develop research for ITS projects.

UTA

Assign an ITS specialist.
Attend ITS Task Force meetings.
Review transit literature for ITS funding sources.
Review, update, and include transit projects into ITS Plan.
Implement Transit related ITS technologies.

Salt Lake City International Airport

Advisory member of ITS task force.
Attend ITS Task Force.
Assign person to review manuals.

State of Utah ITS (Information Technology Service)

Attend ITS Task Force.
Review communications and network requirements.

UTC

Attend ITS Task Force as an advisory member.
Assist in developing private partnerships with UDOT to implement ITS projects.
Assist and develop research for ITS projects.

Utah State University

Advisory member of ITS Task Force.

Training

The following courses are recommended to increase the level of understanding in ITS.

FHWA Training Courses

ITI Executive Summary and Benefits/Costs.

This one-day seminar provides a general understanding of ITS and Intelligent Transportation Infrastructure (ITI). Through showcasing ITS systems deployed nationwide, the seminar will illustrate the ITI components which include planning, design, architecture, standards, procurement, installation and construction, operation and maintenance, and funding. Qualitative and quantitative benefits through ITS will be presented through examples and to acquaint those who will be involved with implementation of ITS issues relating to the benefits and costs.
Who Should Attend: Executives, Division or Department Managers, and Regional Directors.

***ITI** Public Private Partnerships*

Various types of partnerships such as public/private combined jurisdictions and private sector to several adjacent public agencies are discussed and models are presented in this one-day seminar. Partnership impediments, risk sharing in ITS partnerships, and case studies are addressed in this course.
Who Should Attend: Planners, ATMS Managers.

Innovative Project Delivery and Financing Strategies for ITI Deployment

A basic understanding of alternative ITI project delivery strategies that includes conventional design-build, private construction and operations with an examination of alternative ITI financing strategies, federal-aid funding, state and local funding and innovative financing are offered at this one-day course.
Who Should Attend: Those involved in determining funding.

ITI Within the Transportation Planning Process

This seminar provides participants with a presentation on information required to deploy ITI infrastructure. Typical state and metropolitan planning procedures are discussed that provide principles of sound ITS planning including topics such as strategic planning, performance criteria, benefit and cost analysis, project development, financial planing, and working with the private sector. Keys to success for building, integration and operating ITS over a time with a presentation of case studies are examined in this day and a half course.
Who should attend: Managers.

Systems Engineering for ITS Deployment

This two-day seminar presents systems engineering and how it enables the National ITS Architecture to be used for ITS deployment. Course participants should be able to advocate the benefits using systems engineering and the National ITS Architecture to guide the implementation of ITS and the ITI.
Who Should Attend: Managers and their Technical Staff.

ITS Telecommunications (Technical and Policy Issues)

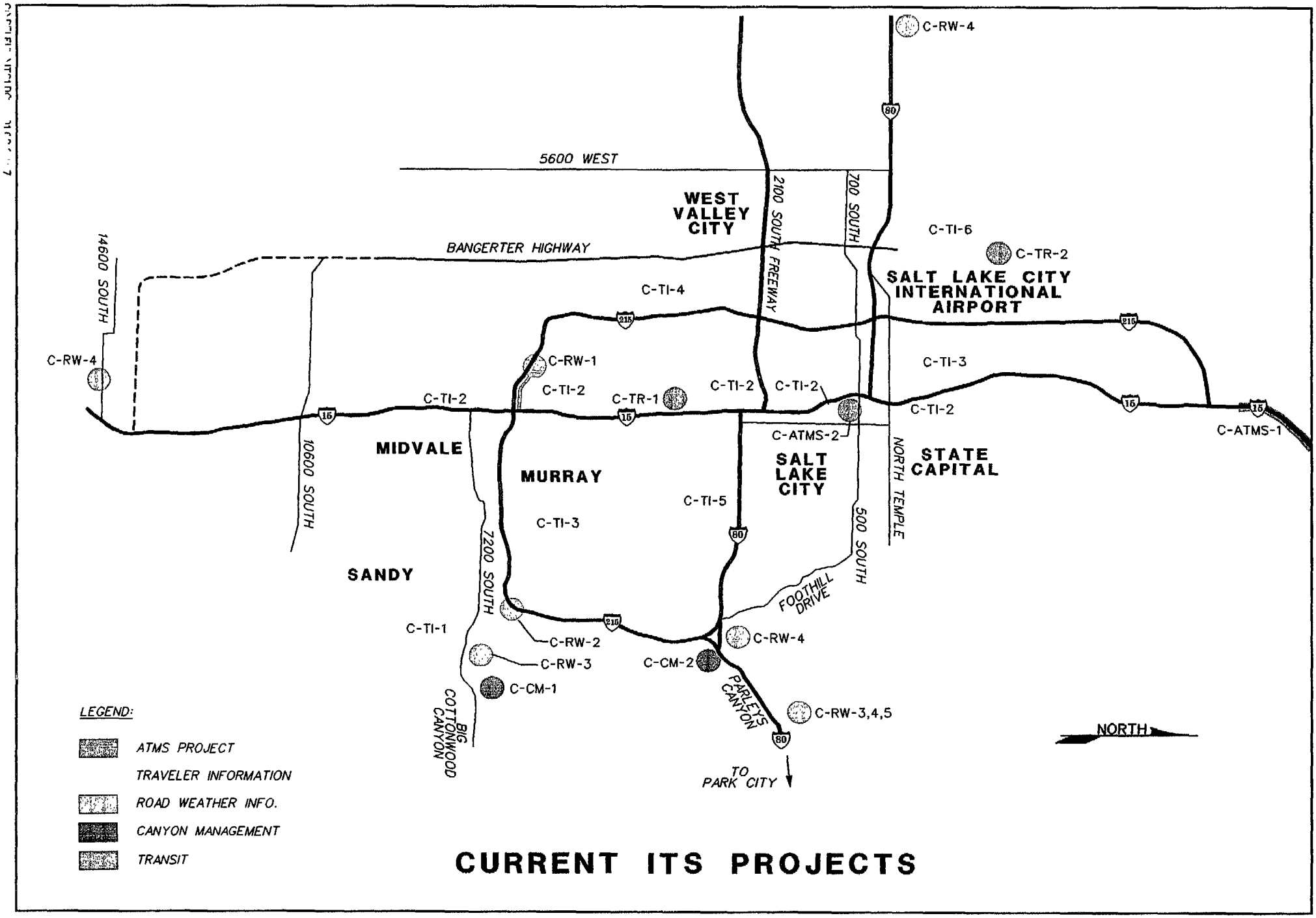
The goal of this one day seminar is to familiarize participants with current issues surrounding telecommunications infrastructures related project deployment. Basic telecommunications concepts and issues related to hard wire and wireless as well as telecommunication technology acquisition are presented.
Who Should Attend: Technical Managers.

National Highway Institute Courses

Computerized Traffic Signal Systems, Traffic Control Software and Signalization, Human Factors: Principles for Highway, Traffic and Design Engineers, Traffic Management Strategies, Intelligent Vehicle Highway Systems (IVHS) Planning and Functional Requirements, Advanced Traffic Signal Controller, Freeway Traffic Operations.
Who Should Attend: Technical Staff should attend as funding/time allows.

ITS America

Attend ITS America.
Who Should Attend: ITS Engineer, TOC Manager, Congestion Management Engineer, and other ITS Project Managers as funding is available.



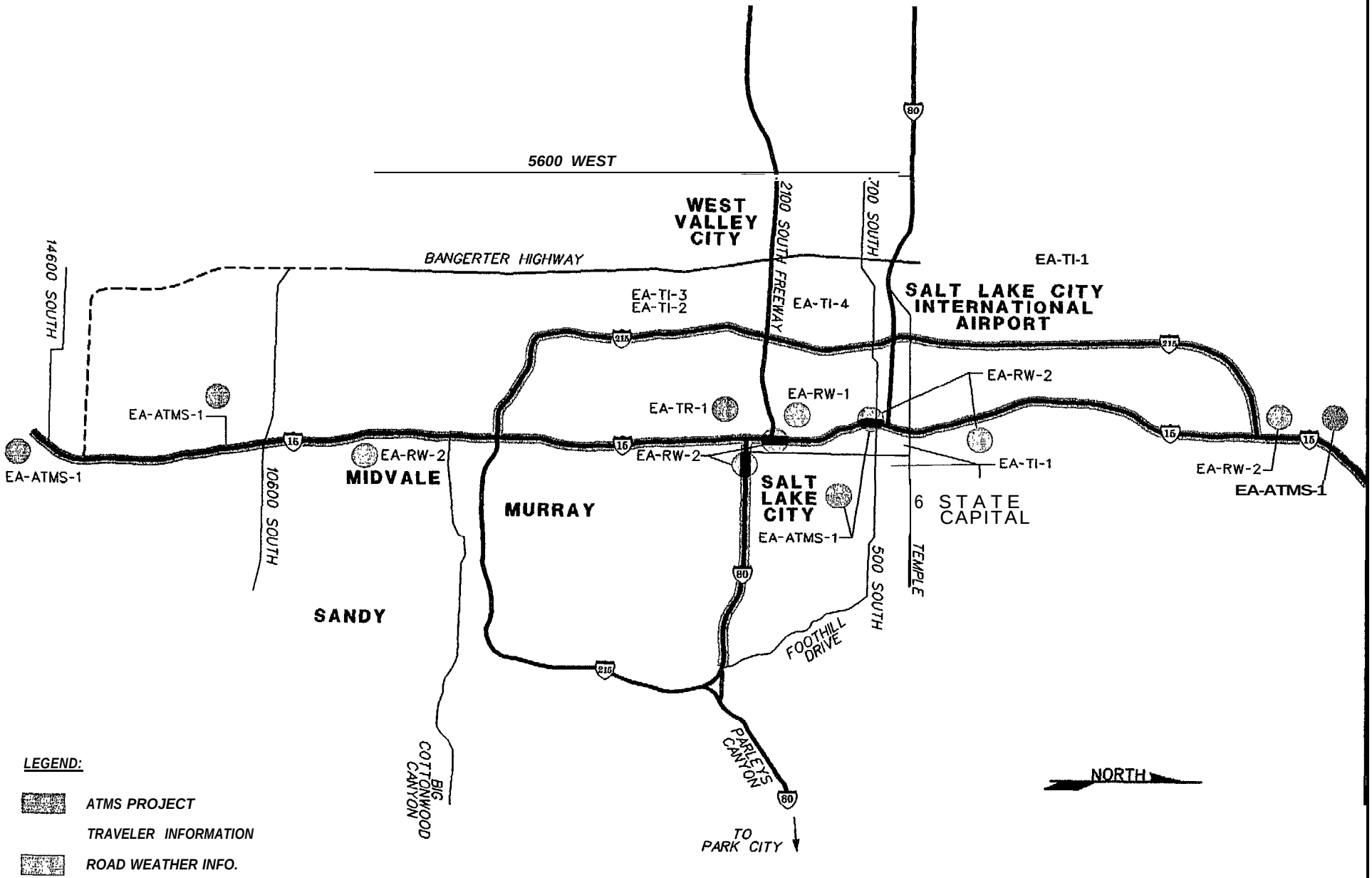
CURRENT ITS PROJECTS

	PROJECT NAME/ #	DESCRIPTION	AGENCY	APPLIED TECHNOLOGIES	CONTACT PERSON
Current ITS Projects					
ATMS	Ramp Metering/ C-ATMS-1	North of I-215 on I-15 through Davis County Parrish Lane, 4th N, 5th S (southbound only). Information to the public through media involvement. System began operation on September 24, 1996 Installation of ramp meters for northbound Beck St., 2600 S will follow in 1997.	UDOT, Traffic Safety	Eagle RMC 300 Controller time of day Central monitoring/downloadable (dial-up/download) Video Collection: Peek Video Trac 900 collects speeds and volumes. 3 cameras, detect SB 1-15	Dave Kinnecom, UDOT (801) 965-4910 Mike Holling, JHK (801) 293-1920
	Queue Detection/ C-ATMS-2	6th South Video Queue detection for steel structure where inductive loops cannot be used. (Temporary Placement)	UDOT, Research	Video Detection 1 Processor 3 Cameras - fixed focus	Chris Glazier (801)965-4381
TRAVELER INFO	Integrated Transportation Information Services (ITIS)/ C-TI-1	Through the use of variable message signs and other potential communication devices, inform recreationalists (for Big and Little Cottonwood Canyons) of current parking area status. These communication devices would provide alternate parking information. Proposed for year 1997, electronic signs, approximately 10 ft high, which would provide number of parking spaces available at ski areas with an additional sign used for current canyon status (open or closed). Sign operations to be controlled remotely at Snowbird.	Salt Lake County, Engineering	Types of technologies to be determined	Teri Braughler (801) 468-2595

TRAVELER INFO (cont)	Public/Private Information Systems/ C-TI-2	Eye-in-the-Sky broadcast every 10 minutes (reporting on the 9's) that includes updated traffic information reported by Duane Southwick from the airplane circulating the SLC area. Duane works with UHP to identify problem traffic areas. Listeners can call "Tipster Traffic Line" at *311 to report traffic problems. KSL's Web Page provides weekly updated construction information pertaining to traffic operations. Traffic Link System. Video cameras placed along the freeway system to monitor traffic conditions. Initial placement of 3 cameras with future implementation to include 7 to 13 additionally cameras.	KSL Radio Utah Highway Patrol UDOT KSL Radio KSL Radio and TV	Duane Southwick and pilot use radio transmitting technologies, police scanners, and radio communication devices to receive and transmit real-time information to KSL listeners. KSL Radio receives weekly update reports from UDOT , via fax and mail, which is added to their WEB Page information relating to traffic. 3 video cameras Fiber optics	Rod Arquette (801) 575-5500 Web Page Address: www.ksl.com Rod Arquette (801) 575-5500
	Air Quality/ C-TI-3	21 air quality stations located along Wasatch Front 5 air quality stations located in remote locations through Utah.	UDOT, Division of Air Quality	Data Systems collect one or more of the following: 6 criteria pollutants, ozone, wind speed, humidity and temperature.	Robert Dalley (801) 322-9900 x902
	Internet/ C-TI-4	Internet Home Page: 3-minute intervals for real time	UDOT, Research	Internet System	Chris Glazier (801) 965-4381
	Incident Management Team HAR/ C-TI-5	Highway Advisory Radio (HAR) system on I-80 with 2 unused-negotiating joint use portable-broadcasts on 530 AM. One mile range (5 miles at best)	UDOT, Public Safety and Incident Management Utah Highway Patrol	Existing Highway Advisory Radio System 10 Watt 1530 AM Frequency	Ritchie Taylor (801) 975-4811
	HAR System/ C-TI-6	Highway Advisory Radio system that is used to assist motorists going to/from the Salt Lake City Airport. The information broadcasts at this time provide vehicular traffic and parking information relating to the Airport.	Salt Lake City International Airport	10 Watt Radio System 1200 AM Frequency	Steve Domino (801) 575-2991

CANYON MNGT	VMS/Big Cottonwood Canyon/ C-CM-I	VMS placement along the Big Cottonwood Canyon. Two lines of 18' text, blank-out capabilities, iridescence lighting, with continuous messages to report road conditions and closures. Sign operation is controlled by TCC.	UDOT Maintenance Region 2	Wedge Base Single Face Electronic Message Center YESCO Prism Display Svstems (Point)	Dave Eixenberger (801) 965-4093
	VMS/Parley' s Canyon/ C-CM-2	Variable Message Signs providing information on tire chain requirements as well as accident and weather alerts for eastbound lanes along Parley's Canyon (East bound I-80). Sign operation will be controlled by TCC.	UDOT, Maintenance Region 2	Wedge Base Single Face Electronic Message Center YESCO Prism Display Systems (Point)	Dave Eixenberger (801) 965-4093
RW ROAD WEATHER	Adverse Visibility Warning System (ADVISE)/ C-RW-1	Visibility sensors automatically activate VMS warning signs giving advisory speeds based on AASHTO safe stopping distance. Site is located on I-21 5 near Murray Golf Course. An evaluation will be done to see how traffic will react to test messages.	UDOT Research and Development. $400,000 up Rockwell International $20,000 O&M	Sign Control-modem traffic center/visibility sensors-radio RF Broadband spread spectrum YESCO bulb dot matrix sign	Lou Boynton Chris Glazier (801) 965-4381 Bill Patrolia Rockwell International (801) 776-2101
	National Cooperation Highway Research Program (NCHRP) Bridge De-icing Experimental Project/ C-RW-2	Sensors in bridge decks transmit to an automated system that dispenses a chemical compound on bridges to prevent ice build-up. Winter 1996-97. 6200/I-215 Knudson Corner, SLC	University of Utah UDOT Research and Qevelopment	Sensor equipment	Professor Rand Decker (801) 581-3403 Doug Anderson (801) 965-4377
	NCHRP IDEA (avalanche closure)/ C-RW-3	An experimental program closing roads as avalanche dangers occur. Avalanche sensors would transmit messages that would provide automatic gate closures across the affected roadways. VMS signs integrated within the system to warn motorists of road closures.	University of Utah UDOT Research and Development	Sensor equipment	Professor Rand Decker (801) 581-3403 Doug Anderson (801) 965-4377

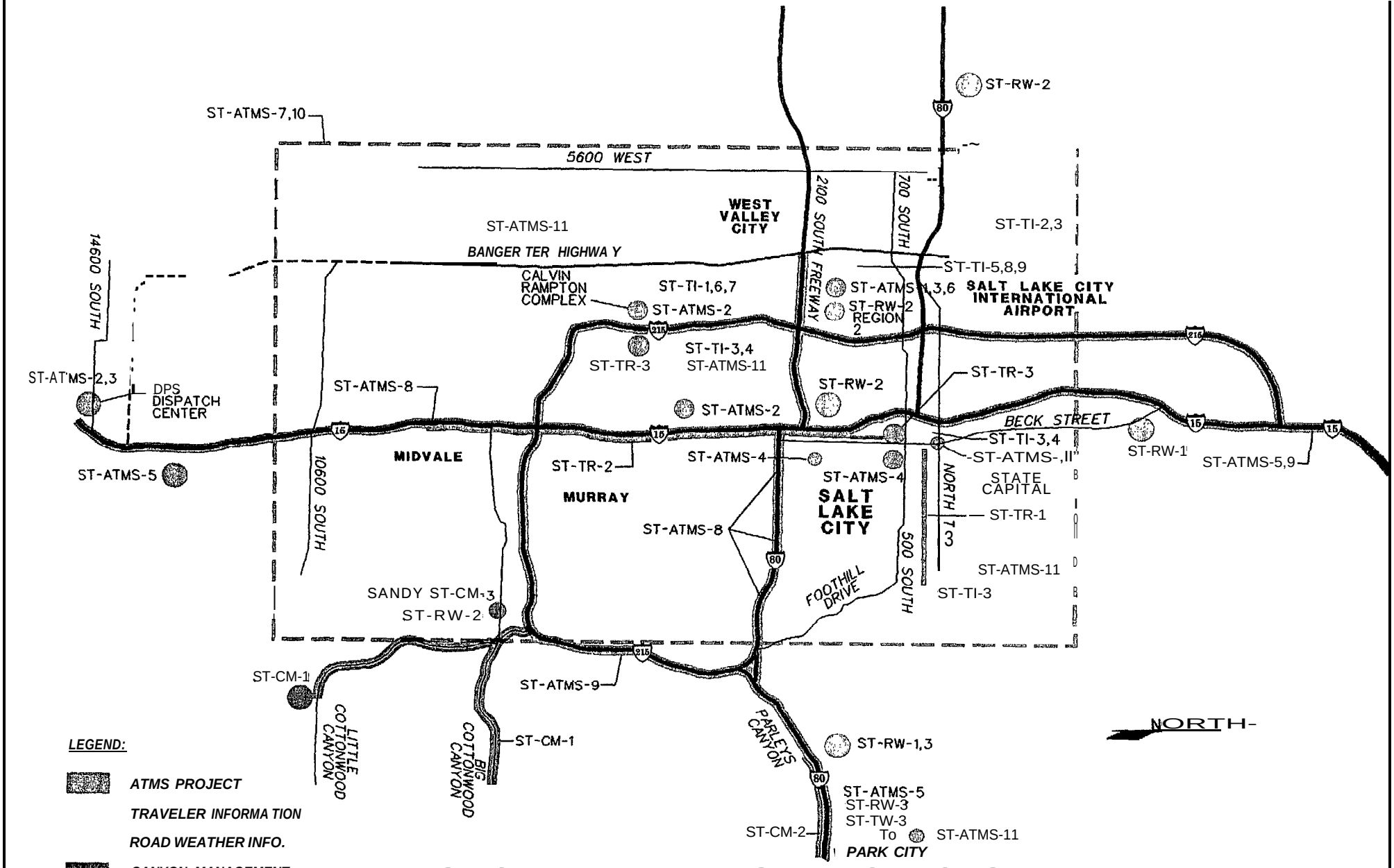
RWI (cont)	SCAN Systems/ C-RW-4 (not shown on map)	J-SCAN system on I-80, I-215, and I-15. 2-SCAN systems in Weber Canyon that include 8 sensors. Four additional sensors are used at SR 91 Sardine Summit, approximately MP 13.	UDOT, Maintenance, Region 2 Region 1	SCAN Systems, SSI, above ground sensors to collect temperature, wind velocity, dew point, and salt content data which is collected by station personnel.	Stan Burns (801) 9754951 John Genderson (801) 399-5921
TRANSIT	Communications Upgrade/ C-TR-1	Would permit automated passenger counting, develops updated communications systems as well as allowing for future implementation of Automated Vehicle Location (AVL). Project Subset: Purchase AVL equipment that can initially be rotated to problem corridors. These corridors need to be monitored closely for schedule adherence, passenger loads, and turnover time.	Utah Transit Authority	Communications System designed in house. Mobile data terminal. DM radio. Want design with hard data plug for open architecture to allow for signal pre-emption for the downtown area LRT system Transponders and hardware	Richard Hodges (801) 262-5626 x2354
	AVI/ C-TR-2	Currently using automated vehicle identification (AVI) technologies for tracking commercial vehicles (taxicabs, buses). Information is used for assessing commercial access user fees.	Salt Lake City International Airport	AVI equipment	Victor White (801) 575-2411



EARLY ACTION ITEMS
(PRIOR TO I-15 CONSTRUCTION)

	ITS PROJECT NUMBER	PROJECT NAME	DESCRIPTION	ESTIMATED COST	FUNDING SOURCE
Early Action Project - Projects to be completed before or during I-15 Construction					
ATMS	EA-ATMS-1	Interim TCC and Network Surveillance	Establish Interim Traffic Control Center and Deploy 2 VMS, 10 CCTV and 10 Monitoring Stations using wireless communications.	$2 million	FY 96 Transportation Bill Appropriation
	EA-ATMS-2	Phase I Expansion of Incident Management Public Information Campaign	Expand Incident Management to Include I-215. Increase personnel during peak periods. Increase awareness of incident management services through media and increased signage.	$65,000 capital $270,000 O&M $30,000	I-15 Reconstruction Funds (Contractor)
	SUBTOTAL			**$2,365,000**	
TRAVELER INFO	EA-TI-1	Upgrade of Existing Kiosks	Upgrade Existing State of Utah Kiosks to Include UDOT Daily I-15 Construction. Information and map of travel speeds and conditions as supplied from the TCC. Promotion and Education plan to increase public awareness of Kiosks.	$50,000	Existing fund for State Kiosks ISS Funds
	EA-TI-2	Real Time Internet Graphics	Export TCC graphics to existing UDOT Internet site.	$6,000	To be completed in-house by UDOT ISS staff. TOC Demonstration staff.
	EA-TI-3	Automated Fax and E-mail to Traffic Broadcast	(Information Dissemination) uses numerous fax formations at one time to receive and transmit road, weather, event, construction and accident/incident information.	$170,000	I-15 Reconstruction Funds (Contractor)
	EA-TI-4	Automated Traveler Input Log and Database	Develop database and automated input log for Region 2 to track the traveling public's input, complaints and comments.	$15,000	Develop In-House by Region Traffic and Maintenance Staff

	SUBTOTAL			$241,000	
TRANSIT	EA-TR-1	UTA Radio Communications Upgrade	Modify current 4 channel communications to narrow-band technology and associated equipment.	$750,000	ITS Congressional Funds
	SUBTOTAL			$750,000	
RWI	EA-RW-1	GPS Maintenance Tracking	Install GPS on Snowplow vehicles at Station 225 (SR-20111-I 5) to assist in tracking, scheduling and deployment.	$96,000	Maintenance Funds
	EA-RW-2	Expanded RWIS	RWIS Sites at I-15, I-80/201, 600/500 South, 9000 South, 600 North, I-215.	**$250,000**	I-15 Reconstruction Funds (Contractor)
	SUBTOTAL			**$346,000**	
	TOTAL			**$3,702,000**	



SHORT-TERM ITS PROJECTS

(PRIOR TO 2002)

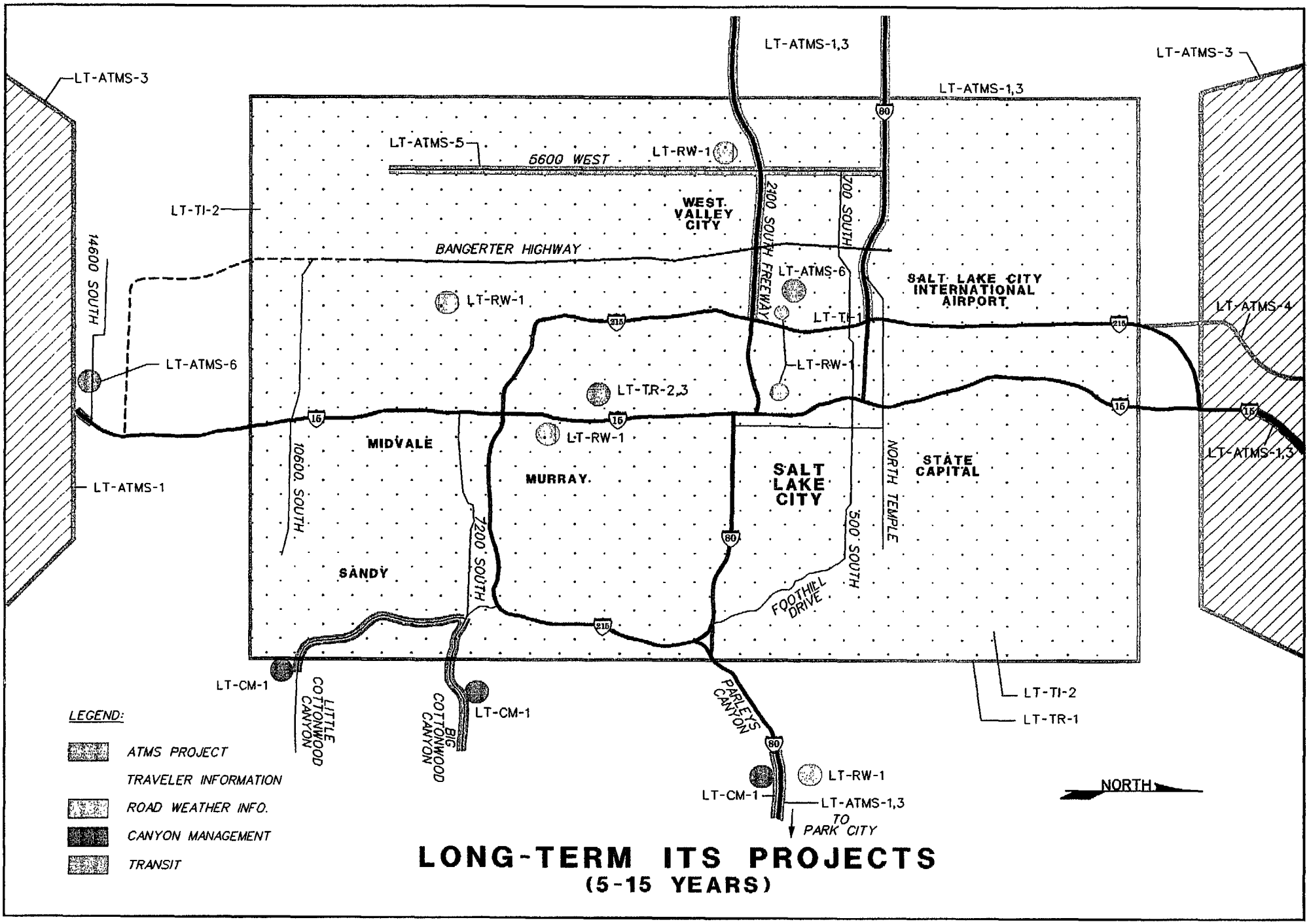
	ITS PROJECT NUMBER	PROJECT NAME	DESCRIPTION	ESTIMATED COST	FUNDING SOURCE
	Short Term Pre-Olympic Projects (O-5 years)				
ATMS	ST-ATMS-1	Regional Traffic Operations Center	Provide a centralized location for signal coordination, freeway traffic management, weather, traffic and roadway information.	$6.5 million	I-1 5 Construction Funds (Deployed under DFCM Project)
	ST-ATMS-2	Multi-Agency TOC Communications Link	Provide fiber-optic communications to and from UTA Dispatch, UHP and Department of Public Safety.	$2 million	Intermodal Funds
	ST-ATMS-3	Computer Aided Dispatch at TOC or UPS (Fred House)	Dispatch system to automate agency calling/faxing upon dispatch operator entering information into computer.	**$50,000**	Olympic Transportation Funds
	ST-ATMS4	Salt Lake County Traffic Control Center	Develop TCC satellite centers for Salt Lake City and SL County.	$800,000	FY 97 Transportation Bill Appropriation (Deployed under ATMS Systems Integrator Project)
	ST-ATMS-5	Expanded Incident Management - Phase II	Expand Incident Management to I-80, Parleys Canyon, I-15 Draper to Centerville. Increase overall hours of operation to have at least 1 staff member present 7 days a week.	$150,000	STP Project INH-15-7(193)316 I-1 5 from I-21 5 to 2600 South
	ST-ATMS-6	Systems Integrator	Deveolp, Install and Integrate Central Software and field firmware for the ATMS Install hardware at UDOT TOC.	$4.2 million	FY 97 Transportation Bill Appropriation (Deployed under ATMS Systems Integrator Project)
	ST-ATMS-7	Regional Communications System	Install fiber optic communications to interconnect over 500 traffic signals, UDOT TOC, City TCC, and County TCC.	$30 million	$23 million from I-15 Reconstruction funds $7 million form CMAQ funds (Deployed under I-15 Reconstruction Project)

ATMS (cont)	ST-ATMS-8	Prototype Lane Use Sign Facility	Develop prototype 6-8 mile Freeway Section, possible I-80, utilizing lane use signs (red X's and green arrows) at 1/4 mile increments to automatically convey lane closure. Where lane is temporarily closed due to incident, forces traffic to merge further back, thus minimizing stop and go traffic.	$3 million	FY 96 Transportation Bill Appropriation Olympic Transportation Funds
	ST-ATMS-9	Freeway Management System	Install 35 VMS, 200 CCTV and 140 monitoring Stations on I-15, I-215, I-80 and SR-201 (70 total miles).	$20 million	I-15 Reconstruction Funds (Deployed under I-15 Reconstruction Project)
	ST-ATMS-10	Arterial Management System	Install 16 VMS. Replace 7,000 cabinets and 521 controllers.	$5 million	$2 million from I-15 Reconstruction Funds $3 million from CMAQ (Deployed under I-15 Reconstruction Project)
	ST-ATMS-11	Surveillance Cameras at Olympic Venues	Surveillance Cameras and Closed Circuit Television to monitor ingress and egress of auto and pedestrian traffic at Olympic Venue Sights.	$400,000	Olympic Transportation Funds
	SUBTOTAL			**$72,100,00**	
TRAVELER INFORMATION	ST-TI-1	En-route/Pre-trip dial up Driver Information	Computer generation voice information would provide pre-taped message. Cable television would proved traffic and traveler information.	$400,000	Private partnership, CMAQ funds Olympic Transportation Funds I-15 Reconstruction (Contractor)
	ST-TI-2	In Vehicle Navigation for Rental Cars	In association with Rental Car Companies, provide in-vehicle navigation, yellow pages and route guidance.	$5 million	Olympic Transportation Funds Private Partner
	ST-TI-3	Pre-Trip Travel Information Kiosks	10 new kiosks at key transportation transfer points and Olympic event locations such as the Airport, University of Utah, the Delta Center , Winter Sports Park and West Valley Stadium. Kiosks would provide travel options, scheduling and real-time information for transit and shuttle buses.	$180,000 10 @ $18,000	Olympic Transportation Funds

TRAVELER INFORMATION	ST-TI-4	Major Event Parking Video Surveillance and Communications Link System	Monitor traffic and parking conditions at park and ride lots, Olympic sites and Light Rail Locations. Video camera surveillance can provide real-time parking information over HAR and VMS's. System directs motorists of available parking and Informs them transit options.	$ 1.5 million $500,000 per site at urban locations (Delta Center, University Of Utah, West Valley Stadium)	ITS Research Funds Olympic Transportation Funds Private Partnering
	ST-TI-5	UHF Television Station	Purchase and Operate UHF Channel to broadcast traffic and traveler information.	$500,000	Olympic Transportation Funds
	ST-TI-6	Expansion of Internet Home Page	Expand to include real time traffic information, and real time transit information.	$20,000	Olympic Transportation Funds Congressional Appropriation I-15 Reconstruction (Contractor)
	ST-TI-7	Real-Time Traffic video on Internet.	Integrate real time information displayed by actual video surveillance to the UDOT home page.	$40,000 (programming and database construction)	Private Partners Existing TOC/ISS Resources I-15
	ST-TI-8	Cellular Telephone Coverage Systems	Route specific travel information such as *1-15 and *I-80 to provide real time en-route information.	$19,000	I-15 Reconstruction Funds (Contractor) Private Partner (Cellular Phone Co)
	ST-TI-9	Automated Travelor Input Log and Database	Expand Automated Travelor Input Log and Database System to forward input to Responsible Individual's E-mail or pager. Display and track results by ARC-VIEW. Integrate with Internet and State Kiosks.	$30,000	I-15 Reconstruction (Contractor) ISS Staff
	SUBTOTAL			**$8,180,000**	
TRANSIT	ST--TR-1	Signal Pre-Emption for Buses	Pre-emption at traffic signals and ramp metering bypasses implemented for temporary transit fleet employed for Olympics.	$2 million	Olympic Transportation Funds

	ST-TR-2	AVL for Light Rail	Install Automatic Vehicle Location devices onto 23 LRT vehicles. Real-time location information is utilized for signal pre-emption, scheduling and passenger information. VMS signs at key stations for passenger information "X minutes until next train".	$1 million	Olympic Transportation Funds
	ST--TR-3	Multimodal Transfer Centers	Construct centers in Salt Lake, West Valley, Ogden and Park City to accommodate multi-modal regional trips through the corridors including local county trips, SOV, bus, van, carpool, bicycle and pedestrian modes.	$8 million	ISTEA Intermodal Funds
	SUBTOTAL			**$11,000,000**	
C A N Y O N M N G T	ST-CM-1	Big/Little Cottonwood VMS Communications	Expand utilization of both canyon VMS signs. After preliminary project use, determine what additional communications features are desired to integrate the signs with traffic operations, maintenance and enforcement.	$500,000	CMAQ Olympic Transportation Funds
	ST-CM-2	Parley's Canyon and US-89 in Farmington, Information and Incident Management	Install weather sensors and video surveillance to manage mountain roads. Provide link to incident management and ATMS. Provide 4 VMS signs in canyon, 2 VMS signs on US-40 and in Park City location to give motorist information. Provide call boxes at high incident locations. Install fiber optic in Parleys Canyon.	$4 million	CMAQ Olympic Transportation Funds Private Partner ships
	ST-CM-3	Avalanche Sign Automation	Provide cellular modem/UDOT LAN Interface to improve/automate flow of information from avalanchce field personnel to UDOT Community Relations, Maintenance and SL Co. Sherrif .	$20,000	Maintenance
	SUBTOTAL			**$4,570,000**	

C V O	ST-CV-1 (not shown on map)	Mobile Port-of-Entry Stations	Van(s) equipped with portable scales, weigh-in-motion pad and mobile communications accessing, permitting, license and fee information. Would monitor specific areas for intra state vehicle travel.	$400,000	National Highway System ITS Research
	ST-CV-2 (not shown on map)	Automated Enforcement Stations	Video surveillance linked to WIM sensors for automated enforcement of overweight vehicles on by-pass routes.	$525,000	Private Partnership Maintenance Funds ITS/CVO Research
	ST-CV-3 (not shown on map)	Commercial Vehicle Administrative Process	Automate permitting and registration procedures. Provide Internet Access. Provide infrastructure to handle increased use of transponders on carriers.	$30,000	National Highway System
	SUBTOTAL			**$955,000**	
R W I	ST-RW-1	Road Weather Information System	Expand RWIS to include additional sites in Parleys Canyon, U.S.-89, I-15, US-89 Centerville, Beck St, and Bangerter.	7 Systems @ $50,000 $350,000	Olympic Transportation Maintenance
	ST-RW-2	Satellite Weather Stations	Turnkey Stations providing accurate weather information to UDOT Regions distributed over LAN.	$60,000 $20,000 o&m costs	ITS Research Maintenance
	ST-RW-3	GPS Maintenance Tracking	Add GPS Tracking to snowplow vehicles at Parleys Canyon and Kimball Junction.	$20,000	ITS Research Olympic Transportation Funds
	SUBTOTAL			**$450,000**	
	TOTAL			**$97,255,000**	



LONG-TERM ITS PROJECTS
(5-15 YEARS)

	ITS PROJECT NUMBER	PROJECT NAME	DESCRIPTION	ESTIMATED COST	POSSIBLE FUNDING SOURCE
Long Term ITS Projects (5-15 years)					
LONG TERM	LT-ATMS-1	Freeway Management Expansion	Expand freeway management from Ogden to Provo (I-15) and from Tooele to Park City (I-80) and SR-201 to Magna.	$25 million	
	LT-ATMS-2	Signal Coordination Expansion	Expand Signal Coordination to include Ogden and Provo.	$5 million two TCC @2.5 million	Traffic Funds
	LT-ATMS-3	Incident Management Expansion Phase III	Expand incident management from Ogden to Provo (1-15), Tooele to Park City (I-80) and SR-201 to Magna. Extend operation to 24 hours per day.	$500,000	
	LT-ATMS-4	Automated Toll Road with Congestion Pricing	Install automated toll collections utilizing smart cards and transponders for automatic payment. Install with new facility such as West Davis Highway.		Self funding Legacy Highway funds
	LT-ATMS-5	Automatic Lane Control Facility	Utilize VMS technology to create reversible lanes, off-peak HOV lanes and lane closure for incident management.	$5 million	
	LT-ATMSB	Emergency Services Communications and Coordination	Install system to handle increasing 911 calls from cellular phones. Provide Computer aided dispatch and agency communications. May replace or be integrated with existing *1 1 system.	$2 million	Department of Public Safety
	SUBTOTAL			$36,500,000	

TRAVELER INFO	LT-TI-1	Communications Infrastructure for MAYDAY support	Develop Communications infrastructure to support in-vehicle "MAYDAY" devices. Infastructure would include additional dispatch space at the Traffic Operations Center.	$400,000	Private partnership, CMAQ funds
	LT-TI-2	Urban HAR/ Public Radio Advisory Station	Install a system of HAR systems to give real-time traffic information at key locations. Investigate automatic (override) HAR. Alternatively, a public station similar to MNDOT, with exclusive override capabilities for traffic reports.	$800,000 20 @ $40,000	Private Partnerships ITS Operational
	SUBTOTAL			$1,200,000	
TRANSIT	LT-TR-2	AVL for Buses	Install Automatic Vehicle Location devices onto busses. Real-time olcationinformation is utilized for signal pre-emption, scheduling and passenger information.	$2 million	Transit Funds
	LT-TR-3	Dial-a-Ride Shuttle Service Para-transit	Utilize existing para-transit vehicle to serve a "neighborhood shuttle service". Communications and computerized telephone systems provide "to your door" pick up and drop off service.	$1.5 million	Transit Funds
	LT-TR-4	Smart Cards	Install automatic payment machines to purchase "smart cards" for fare payment of transit.	$1 million	Transit Funds
	SUBTOTAL			$4,500,000	
CVO	LT-CVO-1	Satellite Tracking	Build infrastructure to accomodate carrier identification for market penentration of prevailing technology, including Satelite tracking, transponders or electronic tag technology.	**512** million	National Highway System
	SUBTOTAL			$12,000,000	

CANYON MANAGEMENT	LT-CM-1	Canyon Information System	Utilize pavement, avalance and traffic sensors to manage canyon traffic including closure. Install fiber optic in canyons.	$4 million	Maintenance Private Partnership CMAQ
	SUBTOTAL			**$4,000,000**	
RR X-ING	LT-RR-1	Railroad Crossing Alert In-Vehicle System	Automatic sensor in vehicle sends alarm from train crossing when train approaches.	$1000 per vehicle $40,000 per x-ing	RR Consortium
	LT-RR-2	Railroad VMS Alert	Install VMS at high accident train crossings.	$80,000	HES Funds
	LT-RR-3	Railroad Grade Crossing Monitoring System	Provide emergency train warning system to trains for event of vehicle stall on tracks.	$1.5 million	HES Funds
	SUBTOTAL			**$1,621,000**	
RWI	LT-RW-1	GPS - RWIS Fleet Information System	Integrated System with entire maintenance fleet on GPS receiving real time RWIS information.	$4 million	ITS Operational Maintenance
	LT-RW-2	Maintenance Communications Link	Add fiber optic connection to maintenance sheds via FTMS fiber.	$2 million 20 maintenance sheds @ $100,000	Maintenance & National Highway System
	SUBTOTAL			**$6,000,000**	
	TOTAL			**$65,821,000**	

ACRONYMS

APTS	Advanced Public Transit Systems
ATIS	Advanced Traveler Information System
ATMS	Advanced Traffic Management Systems
AVL	Automatic Vehicle Location
AVSS	Advanced Vehicle Safety Systems
CMAQ	Congestion Mitigation & Air Quality
CVO	Commercial Vehicle Operations
EM	Emergency Management
FHWA	Federal Highways Administration
FTE	Full Time Employee
GIS	Geographic Information
GPS	Global Positioning System
HAR	Highway Advisory Radio
HES	Hazard Elimination and Safety
ISS	Information System Support (UDOT)
ITI	Intelligent Transportation Infrastructure
ITS	Intelligent Transportation System
LAN	Local Area Network
LRT	Light Rail Transit
LRV	Light Rail Vehicle
OATS	Ogden Area Transportation Study
RWIS	Road Weather Information System
SL	Salt Lake
SLATS	Salt Lake Area Transportation Study
SOV	Single Occupancy Vehicle
TCC	Traffic Control Center (refers to City, County)
TOC	Traffic Operations Center (UDOT)
UDOT	Utah Department of Transportation
UHP	Utah Highway Patrol
UTA	Utah Transit Authority
UVATS	Utah Valley Area Transportation Study
VMS	Variable Message Sign
WFRC	Wasatch Front Regional Council

PROJECT NUMBERING SYSTEM

xx-yy-#

XX = -Time Frame

C	Current
EA	Early Action (O-l years)
LT	Long Term
ST	Short Term

YY = Project Category

ATMS	Advanced Traffic Management Systems
C V O	Commercial Vehicle Operations
RR	R a i l r o a d
RW	Road Weather
TI	Traveler Information
TR	Transit

TASK FORCE ATTENDEES

NAME	AGENCY/DIVISION	TITLE	PHONE NO.
Michael Allegra	Utah Transit Authority	Assistant Director	466-4697
Doug Anderson	UDOT, Research	Director	965-4377
Doug Basset	UDOT, Region 3	Traffic Engineer	227-8019
John Baxter	FHWA, Utah Division		863-0093
Jerry Blair	Salt Lake City Public Services	Transportation Operations Engineer	535-7103
Teri Braughler	Salt Lake County, Engineering	Engineer	468-2595
Sara Colosimo	DeLeuw, Cather & Company	Project Manager	553-3305
Mick Crandall	Wasatch Front Regional Council	Program Manager	299-4469
Steve Domino	Salt Lake City International Airport	Director of Planning	575-299 1
Dave Eixenberger	UDOT, Maintenance - Central	Maintenance/Central	965-4093
Chris Glazier	UDOT, Research	Research Engineer	965-4381
Glenn Goodrich	UDOT, Motor Carriers	Director	965-4156
Glenn Havinoviski	JHK & Associates	Project ITS Technical Advisor	(714)758-0019
Dal Hawks	UDOT, Research	Development Engineer	965-4324
Richard Hodges	Utah Transit Authority	Engineer	262-5626
Sharon Holland	UDOT, Information System Services	Programmer	965-4824
Mike Holling	JHK & Associates		293-1920
Skip Hudson	FHWA	Utah Division	963-0182
Peter Hwang	UDOT	ITS Engineer	965-4000
Tammy Kaeser	UDOT, Program Development	Information Specialist	965-4137
David Kinnecom	UDOT, Traffic & Safety	Traffic Manager Engineer	965-4910
Michael Krueger	JHK & Associates		(714)758-0019
Gary Kuhl	UDOT, Planning	Congestion Management	965-4552
John Leonard	UDOT, I-15	Traffic Engineer	281-8167
Norm Lindgren	UDOT, Motor Carrier	Director of Motor Carrier	965-4325
Shana Lindsey	UDOT, Maintenance - Central	Engineer	965-4885
Dennis Moss	UDOT	Information Systems Service	965-4490
Sam Musser	UDOT, Research	Research Coordinator	965-4568
Rachel Parkhurst Miller	Utah Air Quality	Engineer	536-4027
Dick Rauschmeier	Union Pacific Railroad	Manager, Industry, and Public Project	595-3560
Barbara Schroeder	DeLeuw, Cather & Company	Project Manager Support	553-1944
John Stucki	State of Utah	Information Technology Services	538-3828
Ritchie Taylor	UDOT, Region 2	Traffic Engineer	975-4811
George Thompson	UDOT, Program Development	Programming Engineer	965-4552

Proposed ITS Task Force Membership and Duties

Mission: To implement ITS Plan.
Official Authority: Review and approve proposed ITS projects through ITS Project Review Form.

Voting Members:

(2) Planning Congestion Management Engineer (Chair - Alternating Years)
Data Collection - Information Analyst
(2) Traffic & Safety (Chair - Alternative Years)
ITS Engineer - Traffic Engineer
(1) Research
(1) Motor Carrier
(1) ISS
(1) Maintenance Central
(1) Community Relations
(2) Region 2
(Traffic Engineer)
(TOC Engineer)(may be Region or Central)
(1) WFRC <Expand to MAG member as systems are implemented>
(1) Salt Lake City
(1) Salt Lake County
(1) UTA
Total 14 Voting Members

Advisory Members:

FHWA	Division of Air Quality
University of Utah	I-l 5 Team
Consultant Member	State of Utah ITS

ITS Project Review Form

This form is to be completed in the project concept phases. The project sponsor or champion should complete the form, and gain approval from the ITS Task Force. The intent is to coordinate the ITS Effort and avoid duplication of function, personnel and equipment.

PERFORMANCE CRITERIA Pre-Project Guidance Questions		
Problem Definition		
	What is the existing problem?	Description:
	Is there anecdotal evidence to support this?	Public complaints, staff, law enforcement, media?
	Is there statistical evidence to support this?	Number of accidents, vehicle speeds, travel/incidence response times, etc.
	What benefits do we expect from this project?	List:
Public Acceptance		
	Has the public specifically asked for this type of a service?	Yes/No
	Has the public generally asked for this type of service?	Yes/No
	Are the needs identified in the ITS User Service Plan?	Yes/ No
	Are the Goals and Objectives met that were identified in the ITS User Service Plan?	Yes/No
Lead Agency Acceptance		
	Is there a champion for this project at the staff/project engineering level?	Yes/No
	Are there other agencies who support this champion with development of this project?	Yes/No
	Is there a champion at the Executive level?	Yes/No
Other Public Agency Acceptance		
	What other Public Agencies are involved?	List:
	How and to what degree are the other Public Agencies involved?	List:
	Are any formal inter-agency agreements needed? Is there a precedent?	Yes/No Yes/No

Operations and Maintenance Support		
	What are the long term staffing needs?	Monthly Hours? Level of Skill?
	What is the O&M Cost Estimate?	List:
	What is the funding mechanism for O&M?	List:
	Who will maintain the project short term? Long Term?	List: List:
Private Sector Support		
	Is there current or potential private sector support?	Yes/No
	What is the level of support ?	List:
	Potential for commercialization?	Yes/No
Systems Criteria		
	Is this system compatible with existing equipment?	Yes/No
	Is this system compatible with future equipment?	Yes/No
	Does this system support other projects? How much does this system support other project?	Yes/No List:
Data Collection		
	Is the system capable of collecting and disseminating data?	Yes/No
	Can the collected data be used for other agencies? What agency/jurisdiction will maintain data collection?	Yes/No
ITS Strategic Plan		
	Is this project consistent with the ITS Plan?	Yes/No
ITS Task Force Review/Approval		
	Reviewed by: (Task Force Chair) Signature:_____	Date:

Cost Estimating Procedure

This cost estimating procedure is provided for Early Action and Short-Term projects to give background on What assumptions were made in costing ITS projects. Line item costs were taken from local project costs (where available), FHWA guidelines, and ITS projects in other states. Long term projects are not broken down to this level of detail.

COST ESTIMATE

EA-ATMS-1 — **INTERIM TCC AND NETWORK SURVEILLANCE**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration[1]	hr.	$30	350	$10,500	
Planning[2]					
Agency	hr.	$30	800	$24,000	
Consultant	hr.	$80	350	$28,000	
Subtotal Development					$34,500
Design					
Software Design[3]	hr.	$120	5000	$600,000	
Construction/Installation PS&E:					
Agency				$0	
Consultant	hr.	$75	4000	$300,000	
Subtotal Design					$900,000
Deployment					
Advertisement/Bid	hr.	$30	100	$3,000	
Equipment Procurement	hr.	$30	100	$3,000	
TCC Features:[4]					
Remodeling/Furnishings	ea.	$160,000	1	$160,000	
Hardware	ea.	$400,000	1	$400,000	
Communications Hub	ea.	$110,000	1	$110,000	
Field Elements:					
Monitoring Stations	ea.	$16,000	10	$160,000	
VMS	ea.	$210,000	2	$420,000	
CCTV	ea.	$42,000	10	$420,000	
Wireless Communication	per device	$15,000	22	$330,000	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation	hr.	$30	1000	$30,000	
Subtotal Deployment					$2,036,000
Operations & Maintenance (per annum)					
Staffing					
Operations	hr.	$30	8080	$242,400	
Maintenance	hr.	$30	250	$7,500	
O&M Equipment/Supplies/Materials[5]	LS	$200,000	1	$200,000	
Subtotal O&M					$449,900
Grand Total					**$3,420,400**

[1]Assumes agency project manager to initiate project and coordinate planning and deployment activities.
[2]Assumes development of a project work plan; evaluation plan; and marketing/public relations plan.
[3]Includes software development for systems management, VMS, CCTV, incident detection, and any required customization.
[4]Assumes that existing building space will be leased.
[5]Includes $100,000 per annum software maintenance.

COST ESTIMATE

EA-ATMS-2 **PHASE I-INCIDENT MANAGEMENT SYSTEM EXPANSION**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
ProjectDevelopment					
Management/Administration[1]	hr.	$30	120	$3,600	
Planning[2]					
Agency	hr.	$30	320	$9,600	
Consultant	hr.	$80	100	$8,000	
Subtotal Development					$13,200
Design					
Software Design				$0	
Construction/Installation PS&E:					
Agency				$0	
Consultant				$0	
Subtotal Design					$0
Deployment					
Advertisement/Bid				$0	
Equipment Procurement				$0	
Truck/Fully-Equipped[3]	ea.	$30,000	2	$60,000	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Start-up/Evaluation[4]	hr.	$30	160	$4,800	
Subtotal Deployment					$64,800
Operations & Maintenance (per annum)					
Staffing					
Operations[5]	hr.	$30	8080	$242,400	
Maintenance	hr.	$30	104	$3,120	
O&M Equipment/Supplies/Materials'	LS	$25,000	1	$25,000	
Subtotal O&M					$270,520
Grand Total					$348,520

[1] Assumes agency project manager to initiate project and coordinate planning and deployment activities.
[2] Assumes development of a project work plan; evaluation plan; and marketing/public relations plan.
[3] Assumes capital cost to purchase truck outright plus equip it with appropriate tools and supplies for motorist aid.
[4] Assumes agency personnel-40 hours training for 2 new full-time and 2 part-time patrollers; 1 half-time person to implement and maintain public information campaign.
[5] Assumes 2 full-time and 2 part-time (am and pm peaks-6 hours per); full-time patrollers would perform evaluation.
[6] Assumes staff time for regular vehicle maintenance.
'Assumes lump sum estimate for such things as supplies provided to motorists; gasoline, oil, parts for vehicle maintenance; communications air time; supplies provided to motorists (ie, patches to fix flats, belts, gas),

COST ESTIMATE

EA-TI-1 — **UPGRADE EXISTING KIOSKS**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration[1]	hr.	$30	160	$4,800	
Planning[2]					
Agency	hr.	$30	200	$6,000	
Consultant	hr.	$80	150	$12,000	
Subtotal Development					$10,800
Design					
Software Design[3]	hr.	$150	80	$12,000	
Construction/Installation PS&E				$0	
Agency					
Consultant				$0	
Subtotal Design					$12,000
Deployment					
Advertisement/Bid				$0	
Equipment Procurement				$0	
Computer Upgrades[4]	ea.	$500	10	$5,000	
Interconnect (TCC to Kiosk)[5]	ea.	$100	10	$1,000	
				$0	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation[6]	hr.	$30	80	$2,400	
Subtotal Deployment					$8,400
Operations & Maintenance (per annum)					
Staffing					
Operations[7]	hr.	$30	260	$7,800	
Maintenance[8]	hr.	$30	240	$7,200	
O&M Equipment/Supplies/Materials[9]	LS	$5,000	1	$5,000	
Subtotal O&M					$20,000
Grand Total					**$51,200**

[1]Assumes agency project manager to initiate project and coordinate planning, design, and deployment activities.
[2]Assumes development of a project work plan; evaluation plan; and marketing/public relations/education plan. Consultant costs include time for an agency Consultant Project Manager to oversee work. Because consultant has resources to produce work in less time, schedule must be considered.
[3]Assumes consultant would modify kiosk software to accept traffic information and map.
[4]Assumes necessary hardware (larger hard drive; modem; processor upgrade) for kiosk computers to accept additional real time graphical data.
[5]Assumes dedicated telephone land line connection between TCC and kiosk.
[6]Assumes installation of new equipment at TCC and kiosks; testing to ensure that system operates as expected.
[7]Assumes 1 hour per day (weekdays only) for TCC operator to verify that real-time data is downloaded to kiosks and perform project evaluation activities.
[8]Assumes 1 hour per week per kiosk to maintain equipment/upgrade software as necessary.
[9]Assumes other miscellaneous costs such as phone line monthly cost to kiosk; supplies/parts for maintaining computers.

COST ESTIMATE

EA-TI-2 — **REAL TIME INTERNET GRAPHICS**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Deveiopment					
Management/Administration[1]	hr.	$30	40	$1,200	
Planning					
Agency				$0	
Consultant				$0	
Subtotal Development					$1,200
Design					
Software Design[2]	hr.	$30	80	$2,400	
Construction/Installation PS&E				$0	
Agency					
Consultant				$0	
Subtotal Design					$2,400
Deployment					
Advertisement/Bid				$0	
Equipment Procurement				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation	hr.	$30	40	$1,200	
Subtotal Deployment					$1,200
Operations & Maintenance (per annum)					
Staffing				$0	
Operations					
Maintenance	hr.	$30	40	$1,200	
O&M Equipment/Supplies/Materials	LS	$150	1	$150	
Subtotal O&M					$1,350
Grand Total					$6,150

1 Assumes agency project manager to initiate project and coordinate planning, design, and deployment activities.
2 Assumes development of any interface algorithms to transfer data.
3 Assumes consultant would modify kiosk software to accept traffic information and map.

COST ESTIMATE

EA-TIS AUTOMATED **FAX/E-MAIL** FOR TRAFFIC BROADCAST

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration				$0	
Planning'					
Agency	hr.	$30	160	$4,800	
Consultant				**$0**	
Subtotal Development					$4,800
Design					
Software Design				$0	
Construction/Installation PS&E				**$0**	
Agency					
Consultant				$0	
Subtotal Design					$0
Deployment					
Advertisement/Bid				$0	
Equipment Procurement				$0	
Dedicated Computer	ea.	$1,500	1	$1,500	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation	hr.	$30	80	$2,400	
Subtotal Deployment					$3,900
Operations & Maintenance [per annum)					
Staffing					
Operations	hr.	$20	2040	$40,800	
Maintenance	hr.	$30	60	$1,800	
O & M Equipment/Supplies/Materials[2]	L S	$120,000	1	$120,000	
Subtotal O&M					$162,600
Grand Total					**$171,300**

Development and coordination to establish "Public information Officers" to collect data and download to 3rd party broadcast fax provider.

[2] Assumes 3rd party provider provides broadcast fax service, including database development. Cable and Wireless is currently the only telecommunications company that provides this service.

COST ESTIMATE

EA-TI-4 — **AUTOMATED TRAVELER INPUT LOG/DATABASE**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration[1]	hr.	$30	40	$1,200	
Planning					
Agency				**$0**	
Consultant				**$0**	
Subtotal Development					$1,200
Design					
Software Design[2]	hr.	$100	120	$12,000	
Construction/Installation PS&E				$0	
Agency					
Consultant				**$0**	
Subtotal Design					$12,000
Deployment					
Advertisement/Bid				$0	
Equipment Procurement				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation	hr.	$30	40	$1,200	
Subtotal Deployment					$1,200
Operations & Maintenance (per annum)					
Staffing				**$0**	
Operations					
Maintenance				**$0**	
O&M Equipment/Supplies/Materials				**$0**	
Subtotal O&M					$0
Grand Total					$14,400

'Assumes agency project manager to initiate project and coordinate planning, design, and deployment activities.
*Assumes custom programming using an off-the-shelf relational database software package.

COST ESTIMATE

EA-TR-1 — **UTA RADIO COMMUNICATIONS UPGRADE**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration[1]	hr.	$50	120	$6,000	
Planning[2]					
Agency	hr.	$50	320	$16,000	
Consultant				$0	
Subtotal Development					$22,000
Design					
Software Design				$0	
Construction/Installation PS&E:[3]					
Agency	hrs.	$50	80	$4,000	
Consultant				$0	
Subtotal Design					$4,000
Deployment					
Advertisement/Bid				$0	
Equipment Procurement	hr.	$30	100	$3,000	
Base Station	ea.	$50,000	1	$50,000	
In-Vehicle Radios	ea.	$4,000	160	$640,000	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation[4]	hr.	$50	1000	$50,000	
Subtotal Deployment					$743,000
Operations & Maintenance (per annum)					
Staffing					
Operations				$0	
Maintenance	hr.	$30	250	$7,500	
O&M Equipment/Supplies/Materials				$0	
Subtotal O&M					$7,500
Grand Total					**$776,500**

[1]Assumes agency project manager to initiate project and coordinate planning and deployment activities.
[2]Assumes coordination for FCC licensing and preparing vehicle upgrade plan.
[3]Includes specifications, user manuals, protocol development.
[4]Assumes equipment installation (base station and vehicle) and any necessary bus driver training on use of equipment.

COST ESTIMATE

EA-RW-1 — GPS **MAINTENANCE TRACKING**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration[1]	hr.	$30	80	$2,400	
Planning[2]					
Agency	hr.	$30	200	$6,000	
Consultant				$0	
Subtotal Development					$8,400
Design					
Software Design[3]	hr.	$120	500	$60,000	
Construction/Installation PS&E:					
Agency				**$0**	
Consultant				**$0**	
Subtotal Design					$60,000
Deployment					
Advertisement/Bid				$0	
Equipment Procurement:					
GPS Transceivers	ea.	$100	10	$1,000	
Base Station	ea.	$2,000	1	$2,000	
Wireless Communications	ea.	$1,000	10	$10,000	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation	hr.	$30	200	$6,000	
Subtotal Deployment					$19,000
Operations & Maintenance (per annum)					
Staffing					
Operations				$0	
Maintenance[4]	hr.	$30	250	$7,500	
O&M Equipment/Supplies/Materials	LS	**$2,000**	1	$2,000	
Subtotal O&M					$9,500
Grand Total					**$96,900**

[1] Assumes agency project manager to initiate project and coordinate planning and deployment activities.
[2] Assumes planning for and development of an operations plan.
[3] Includes software development customized database programming using off-the-shelf relational database program.
[4] Includes personnel time to maintain equipment and database.

COST ESTIMATE

EA-RW-2 — EXPANDED RWIS

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration'	hr.	$30	40	$1,200	
Planning Agency				$0	
Consultant				$0	
Subtotal Development					**$1,200**
Design					
Software Design[2]	hr.	$120	100	$12,000	
Construction/Installation PS&E: Agency	hr.	$30	120	$3,600	
Consultant				$0	
Subtotal Design					**$15,600**
Deployment					
Advertisement/Bid				$0	
Equipment Procurement:					
Weather Station/Surface Sensor[3]	ea.	$40,000	6	$240,000	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation				$0	
Subtotal Deployment					$240,000
Operations & Maintenance (per annum)					
Staffing Operations				$0	
Maintenance	hr.	$30	80	$2,400	
O&M Equipment/Supplies/Materials	LS	$2,000	1	$2,000	
Subtotal O&M					$4,400
Grand Total					**$261,200**

Assumes agency project manager to initiate project and coordinate planning and deployment activities.
'Assumes upgrade of existing software and processing functions to accept new sites.
[3]Complete in-place.

COST ESTIMATE

ST-ATMS-1 — **REGIONAL TRAFFIC OPERATIONS CENTER**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration	hr.	$30	2080	$62,400	
Planning					
Agency	hr.	$40	300	$12,000	
Consultant	hr.	$160	1000	$160,000	
Subtotal Development					$234,400
Design					
Software Design		$150	2000	$300,000	
Construction/Installation PS&E:		$150	1000	$150,000	
Subtotal Design					$450,000
Deployment					
Advertisement/Bid		$10,000	1	$10,000	
Equipment Procurement					
CCTV	each	$25,000	2	$50,000	
Communications-interconnect	mile	$120,000	15	$1,800,000	
Hardware		$400,000	1	$400,000	
Building		$2,800,000	1	$2,800,000	
Furnishings		$500,000	1	$500,000	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation	hr.	$30	1000	$30,000	
Subtotal Deployment					$5,590,000
Operations & Maintenance (per annum)					
Staffing					
Operations	hr.	$20	6240	$124,800	
Maintenance	hr.	$30	1040	$31,200	
O&M Equipment/Supplies/Materials	LS	$80,000	1	$80,000	
Subtotal O&M					$236,000
Grand Total					**$6,510,400**

COST ESTIMATE

ST-ATMS-2 — **MULTI-AGENCY TOC LINK**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration	hr.	$30	350	$10,500	
Planning					
Agency	hr.	$40	75	$3,000	
Consultant	hr.	$150	800	$120,000	
Subtotal Development					$133,500
Design					
Software Design					
Construction/Installation PS&E:	hr.	$150	800	$120,000	
Subtotal Design					$120,000
Deployment					
Advertisement/Bid	LS	$10,000	1	$10,000	
Equipment Procurement					
Fiber Optic	mile	$240,000	7	$1,680,000	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation				$0	
Subtotal Deployment					$1,690,000
Operations & Maintenance (per annum)					
Staffing					
Operations				$0	
Maintenance	hr.	$30	300	$9,000	
O&M Equipment/Supplies/Materials	LS	$5,000	1	$5,000	
Subtotal O&M					$14,000
Grand Total					**$1,957,500**

Interconnect completed in ST-ATMS-1

COST ESTIMATE

ST-ATMS-3 — **COMPUTER AIDED DISPATCH**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration				$0	
Planning					
Agency				$0	
Consultant				$0	
Subtotal Development					$0
Design					
Software Design					
Construction/Installation PS&E:				$0	
Subtotal Design					$0
Deployment					
Advertisement/ Bid				$0	
Equipment Procurement					
Computer Aided Dispatch System		**$35,000**	1	**$35,000**	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation				**$0**	
Subtotal Deployment					$35,000
Operations & Maintenance (per annum)					
Staffing					
Operations		$20	**520**	**$10,400**	
Maintenance				$0	
O&M Equipment/Supplies/Materials	LS	$5,000	1	$5,000	
Subtotal O&M					**$15,400**
Grand Total					**$50,400**

COST ESTIMATE

ST-ATMS-4 — **SALT LAKE COUNTY TRAFFIC CONTROL CENTER**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration		$30	200	$6,000	
Planning					
Agency		$30	400	$12,000	
Consultant				$0	
Subtotal Development					$18,000
Design					
Software Design		$150	500	$75,000	
Construction/Installation PS&E:		$150	275	$41,250	
Subtotal Design					$116,250
Deployment					
Advertisement/Bid		$4,000	1	$4,000	
Equipment Procurement					
Facility (Office Space)		$60,000	1	$60,000	
Furnishings		$80,000	1	$80,000	
Hardware	system	$350,000	1	$350,000	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation				$0	
Subtotal Deployment					$494,000
Operations & Maintenance (per annum)					
Staffing					
Operations		$20	5200	$104,000	
Maintenance		$20	300	$6,000	
O&M Equipment/Supplies/Materials	LS	$20,000	1	$20,000	
Subtotal O&M					$130,000
Grand Total					**$758,250**

Assume software development is completed with regional traffic operations center
Assume facility is set-up within a trailer or existing Salt Lake County Building

COST ESTIMATE

ST-ATMS-5 — **PHASE II--INCIDENT MANAGEMENT SYSTEM EXPANSION**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration[1]	hr.	$30	300	$9,000	
Planning[2]					
Agency	hr.	$0		$0	
Consultant	hr.	$0		$0	
Subtotal Development					$9,000
Design					
Software Design				$0	
Construction/Installation PS&E:					
Agency				$0	
Consultant				$0	
Subtotal Design					$0
Deployment					
Advertisement/Bid				$0	
Equipment Procurement				$0	
Truck/Fully-Equipped	ea.	$30,000	2	$60,000	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation	hr.	$30	500	$15,000	
Subtotal Deployment					$75,000
Operations & Maintenance (per annum)					
Staffing					
Operations	hr.	$30	1560	$46,800	
Maintenance	hr.	$30	100	$3,000	
O&M Equipment/Supplies/Materials	LS	$10,000	1	$10,000	
Subtotal O&M					$59,800
Grand Total					**$143,800**

COST ESTIMATE

ST-ATMS-6 — **SYSTEMS INTEGRATOR**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration	hrs.	$30	200	$6,000	
Planning					
Agency	hrs.	$30	200	$6,000	
Consultant	hrs.	$150	200	$30,000	
Subtotal Development					$42,000
Design					
Software Design	hrs.	$400	2000	$800,000	
Construction/Installation PS&E:	hrs.	$0	0	$0	
Subtotal Design					$800,000
Deployment					
Advertisement/Bid		$10,000	1	$10,000	
Equipment Procurement					
Hardware	system	$1,500,000	2	$3,000,000	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation	hrs.	$150	2000	$300,000	
Subtotal Deployment					$3,310,000
Operations & Maintenance (per annum)					
Staffing					
Operations				$0	
Maintenance		$20	500	$10,000	
O&M Equipment/Supplies/Materials	LS	$25,000	1	$25,000	
Subtotal O&M					$35,000
Grand Total					**$4,187,000**

Assume software development is completed with regional traffic operations center
Assume facility is set-up within a trailer or existing Salt Lake County Building

COST ESTIMATE

ST-ATMS-7 — **REGIONAL COMMUNICATIONS SYSTEMS**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration	hrs.	$30	200	$6,000	
Planning					
Agency	hrs.	$30	200	$6,000	
Consultant	hrs.	$150	200	$30,000	
Subtotal Development					$42,000
Design					
Software Design	hrs.	$400	2000	$800,000	
Construction/Installation PS&E:	hrs.	$0	0	$0	
Subtotal Design					$800,000
Deployment					
Advertisement/Bid		$10,000	1	$10,000	
Equipment Procurement					
Hardware	system	$1,500,000	2	$3,000,000	
Fiber Optic Cable	mile	$73,000	350	$25,550,000	
				$0	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation	hrs.	$150	2000	$300,000	
Subtotal Deployment					$28,860,000
Operations & Maintenance (per annum)					
Staffing					
Operations				$0	
Maintenance		$20	500	$10,000	
O&M Equipment/Supplies/Materials	LS	$25,000	1	$25,000	
Subtotal O&M					$35,000
Grand Total					**$29,737,000**

Assume software development is completed with regional traffic operations center
Assume facility is set-up within a trailer or existing Salt Lake County Building

COST ESTIMATE

ST-ATMS-8 — **PROTOTYPE LANE USE SIGN FACILITY**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration	hr.	$30	2000	$60,000	
Planning					
Agency	hr.	$20	8000	$160,000	
Consultant	hr.	$150	2000	$300,000	
Subtotal Development					$520,000
Design					
Software Design	LS	$25,000	1	$25,000	
Construction/Installation PS&E:	hr.	$150	2000	$300,000	
Subtotal Design					$325,000
Deployment					
Advertisement/Bid	LS	$10,000	1	$10,000	
Equipment Procurement Misc.				$0	
Lane control hardware	each	$13,000	48	$624,000	
Variable message signs	each	$35,000	8	$280,000	
Signage	each	$5,000	12	$60,000	
System integration	system	$10,000	4	$40,000	
Controller updates for lane control hardware	each	$25,000	4	$100,000	
Surveillance cameras	each	$10,000	12	$120,000	
TOC/Camera hardware	system	$10,000	4	$40,000	
Infrastructure improvements	mile	$200,000	5	$1,000,000	
				$0	
Testing/Training/Start-Up/Evaluation	LS	$20,000	1	$20,000	
Subtotal Deployment					$2,294,000
Operations & Maintenance (per annum)					
Staffing					
Operations	hr.	$20	4160	$83,200	
Maintenance	hr.	$20	1000	$20,000	
O&M Equipment/Supplies/Materials	LS	$20,000	1	$20,000	
Subtotal O&M					$123,200
Grand Total					**$3,262,200**

Assume 12 lane control devices per location

COST ESTIMATE

ST-ATMS-9 **FREEWAY MANAGEMENT SYSTEM**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration	hr.	$30	400	$12,000	
Planning					
Agency	hr.	$40	120		
Consultant	hr.	$150	1000	$150,000	
Subtotal Development					$162,000
Design					
Software Design	hr.	$150	1000		
Construction/Installation PS&E:	hr.	$150	1000	$150,000	
Subtotal Design					$150,000
Deployment					
Advertisement/Bid	LS	$15,000	1	$15,000	
Equipment Procurement					
VMS	each	$35,000	35	$1,225,000	
Hardware/interconnect	each	$10,000	35	$350,000	
Closed Circuit Television	each	$25,000	200	$5,000,000	
Monitoring Stations (Includes inductive loops on each side of freeway with classifies.	each	$78,000	140	$10,920,000	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation	LS	$50,000	1	$50,000	
Subtotal Deployment					$17,560,000
Operations & Maintenance (per annum)					
Staffing					
Operations	hr.	$30	16640	$499,200	
Maintenance	hr.	$30	35000	$1,050,000	
O&M Equipment/Supplies/Materials	LS	$900,000	1	$900,000	
Subtotal O&M					$2,449,200
Grand Total					$20,321,200

Interconnect completed in ST-ATMS-1

COST ESTIMATE

ST-ATMS-10 — **ARTERIAL MANAGEMENT SYSTEM**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration	hr.	$30	200	$6,000	
Planning					
Agency	hr.	$40	300	$12,000	
Consultant	hr.	$150	1000	$150,000	
Subtotal Development					$168,000
Design					
Software Design	hr.	$200	800	$160,000	
Construction/Installation PS&E:	hr.	$150	200	$30,000	
Subtotal Design					$190,000
Deployment					
Advertisement/Bid	LS	$10,000	1	$10,000	
Equipment Procurement					
Variable Message Sign	each	$35,000	16	$560,000	
Hardware/Interconnect	system	$10,000	16	$160,000	
Controller replacement	each	$2,000	521	$1,042,000	
Cabinet replacement	each	$245	7000	$1,715,000	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation				$0	
Subtotal Deployment					$3,487,000
Operations & Maintenance (per annum)					
Staffing					
Operations	hr.	$30	8320	$249,600	
Maintenance	hr.	$30	35000	$1,050,000	
O&M Equipment/Supplies/Materials	LS	$50,000	1	$50,000	
Subtotal O&M					$1,349,600
Grand Total					**$5,194,600**

COST ESTIMATE

ST-ATMS-11 **SURVEILLANCE CAMERAS AT OLYMPICS VENUE**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration	hr.	$30	10	$300	
Planning					
Agency	hr.	$20	60	$1,200	
Consultant				$0	
Subtotal Development					$1,500
Design					
Software Design	LS	$45,000	1	$45,000	
Construction/Installation PS&E:				$0	
Subtotal Design					$45,000
Deployment					
Advertisement/Bid				$0	
Equipment Procurement Misc.				$0	
Closed circuit televisions	each	$25,000	10	$250,000	
System integration	system	$4,000	10	$40,000	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation	LS	$10,000	1	$10,000	
Subtotal Deployment					$300,000
Operations & Maintenance (per annum)					
Staffing					
Operations	hr.	$20	2080	$41,600	
Maintenance	hr.	$20	500	$10,000	
O&M Equipment/Supplies/Materials	LS	$5,000	1	$5,000	
Subtotal O&M					$56,600
	Grand Total				$403,100

COST ESTIMATE

ST-TI-1 **EN-ROUTE/PRE-TRIP DRIVER INFORMATION**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration	hr.	$30	80	$2,400	
Planning Agency	hr.	$40	250	$10,000	
Consultant				$0	
Subtotal Development					$12,400
Design					
Software Design				$0	
Construction/Installation PS&E:	hr.	$150	300	$45,000	
Subtotal Design					$45,000
Deployment					
Advertisement/Bid	LS	$5,000		$5,000	
Equipment Procurement					
HAR Station Pole Mount (dial-in capabiliites, FCC Licences, installations. phone lines)	each	$16,000	15	$240,000	
Signing (active system)	each	$1,000	10	$10,000	
Flashing light controller	each	$4,000	10	$40,000	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Start-up/Evaluation	LS	$2,000	1	$2,000	
Subtotal Deployment					$297,000
Operations & Maintenance (per annum)					
Staffing Operations	hr.	$30	1040	$31,200	
Maintenance	hr.	$30	50	$1,500	
O&M Equipment/Supplies/Materials	LS	$20,000	1	$20,000	
Subtotal O&M					$52,700
Grand Total					**$407,100**

An active S stem includes reciever/decoder at sign that detects tones broadcasted from HAR and actives or deactives lights allowing urgent messages to have flashing capabilites.

Assume moutainous area range of one-to-two miles.

Assume rural area range of three-to-five miles.

For solar capibilities add $12,000 per unit.

Salt Lake Airport System-Ken Imber (801)531-4575.

Customized software network $50,000-$1,000,000 depending upon the size and requirements.

COST ESTIMATE

ST-TI-2 — IN VEHICLE NAVIGATION FOR RENTAL CARS

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration	.	$30	600	$18,000	
Planning Agency Consultant	hr.	$40	1000	$40,000 $0	
Subtotal Development					$58,000
Design					
Software Design		$100,000	1	$100,000	
Construction/Installation PS&E:		$100,000	1	$100,000	
Subtotal Design					$200,000
Deployment					
Advertisement/Bid	LS	$10,000	1	$10,000	
Equipment Procurement					
In-vehicle devices	each	$5,000	500	$2,500,000	
Transmitters		$2,000	500	$1,000,000	
System integration		$2,000	500	$1,000,000	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation	LS	$50,000	1	$50,000	
Subtotal Deployment					$4,560,000
Operations & Maintenance (per annum)					
Staffing Operations	hr.	$30	4160	$124,800	
Maintenance	hr.	$30	2000	$60,000	
O&M Equipment/Supplies/Materials	LS	$40,000	1	$40,000	
Subtotal O&M					$224,800
Grand Total					**$5,042,800**

Global positioning system may be required (1 unit approximately $1000)
Route guidance could be purchased from a service provider, TMC during periods of heavy congesiton, or traffic conditons being provided by digital communications with the infrastructure detailing link status changes.

COST ESTIMATE

ST-TI-3 — **PRE-TRIP TRAVEL INFORMATION KIOSKS**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration	hr.	$30	30	$900	
Planning Agency Consultant	hr.	$40	100	$4,000 $0	
Subtotal Development					$4,900
Design					
Software Design	system	$35,000	1	$35,000	
Construction/Installation PS&E:		$1,500	10	$15,000	
Subtotal Design					$50,000
Deployment					
Advertisement/Bid	LS	$5,000	1	$5,000	
Equipment Procurement					
Kiosk (installation, interconnect, TOC equipment)	each	$9,000	10	$90,000	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation				$0	
Subtotal Deployment					$95,000
Operations & Maintenance (per annum)					
Staffing Operations	hr.	$20	700	$14,000	
Maintenance	hr.	$30	200	$6,000	
O&M Equipment/Supplies/Materials	LS	$10,000	1	$10,000	
Subtotal O&M					$30,000
Grand Total					**$179,900**

COST ESTIMATE

ST-TM-4 MAJOR EVENT PARKING VIDEO SURVEILLANCE/COMMUNICATIONS LINK

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration	hr.	$30	30	$900	
Planning Agency	hr.	$40	80	$3,200	
Consultant				$0	
Subtotal Development					$4,100
Design					
Software Design	system	1 $90,000	1	$90,000	
Construction/Installation PS&E:		$24,000	3	$72,000	
Subtotal Design					$162,000
Deployment					
Advertisement/Bid	LS	$10,000	1	$10,000	
Equipment Procurement					
Video Camera Surveillance Cameras	Per site	$25,000	3	$75,000	
Communications Link	feet	$14	90000	$1,260,000	
				$0	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation				$0	
Subtotal Deployment					$1,345,000
Operations & Maintenance (per annum)					
Staffing Operations	hr.	$20	700	$14,000	
Maintenance	hr.	$30	200	$6,000	
O&M Equipment/Supplies/Materials	LS	$20,000	1	$20,000	
Subtotal O&M					$40,000
Grand Total					$1,551,100

COST ESTIMATE

ST-TM-5 **UHF TELEVISION STATION**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration	hr.	$30	200	$6,000	
Planning					
Agency	hr.	$20	600	$12,000	
Consultant				$0	
Subtotal Development					$18,000
Design					
Software Design				$0	
Construction/Installation PS&E:	hr.	$150	500	$75,000	
Subtotal Design					$75,000
Deployment					
Advertisement/Bid	LS	$5,000	1	$5,000	
UHF Channel				$0	
Cameras	each	$15,000	6	$90,000	
Spot Light	each	$1,000	6	$6,000	
Monitor	each	$7,000	3	$21,000	
Licensing	LS	$10,000	1	$10,000	
System Integration	system	$20,000	6	$120,000	
Cable Integration	mile	$1,000	50	$50,000	
				$0	
				$0	
Resting/Training/Start-Up/Evaluation	LS	$15,000	1	$15,000	
Subtotal Deployment					$317,000
Operations & Maintenance (per annum)					
Staffing					
Operations	hr.	$20	4160	$83,200	
Maintenance	hr.	$20	500	$10,000	
O&M Equipment/Supplies/Materials	LS	$10,000	1	$10,000	
Subtotal O&M					$103,200
	Grand Total				$513,200

Assume cable access (franchise option)thorugh a public broadcasting system is available and does not include cost of tower. Images can be collected and then linked through computer with addtional data entry provided by a staff person. (Cable is approximately $1000 per mile and tower cost approsimatley $500.000 each). Gay Hammer-(970)242-8101

Staffing operations include two full time positions 40 hrs. per week.

COST ESTIMATE

ST-TI-6 **EXPANSION OF INTERNET HOME PAGE**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration	hr.	$30	10	$300	
Planning Agency	hr.	$40	20	$800	
Consultant				$0	
Subtotal Development					$1,100
Design					
Software Design	hr.	$30	280	$8,400	
Construction/Installation PS&E:				$0	
Subtotal Design					$8,400
Deployment					
Advertisement/Bid				$0	
Equipment Procurement				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
Test/Starting Evaluation	LS	$1,000	1	$1,000	
Subtotal Deplovment					$1,000
Operations & Maintenance (per annum)					
Staffing Operations	hr.	$20	290	$5,800	
Maintenance	hr.	$30	100	$3,000	
O & M Equipment/Supplies/Materials	L S	$1,000	1	$1,000	
Subtotal O&M					$9,800
Grand Total					$20,300

Cost Estimate

ST-TI-7 — **Real-Time Traffic Video on Internet**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration	hr.	$30	20	$600	
Planning					
Agency	hr.	$40	40	$1,600	
Consultant				$0	
Subtotal Development					$2,200
Design					
Software Design	hr.	$30	560	$16,800	
Construction/Installation PS&E:				$0	
Subtotal Design					$16,800
Deployment					
Advertisement/Bid				$0	
Equipment Procurement				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation	LS	$1,000	1	$1,000	
Subtotal Deployment					$1,000
Operations & Maintenance (per annum)					
Staffing					
Operations	hr.	$20	600	$12,000	
Maintenance	hr.	$30	200	$6,000	
O&M Equipment/Supplies/Materials	LS	$2,000	1	$2,000	
Subtotal **O&M**					$20,000
	Grand Total				**$40,000**

COST ESTIMATE

ST-TI-8 — **CELLULAR TELEPHONE COVERAGE SYSTEMS**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration				$0	
Planning					
Agency				$0	
Consultant				$0	
Subtotal Development					$0
Design					
Software Design				$0	
Construction/Installation PS&E:				$0	
Subtotal Design					$0
Deployment					
Advertisement/Bid				$0	
Equipment Procurement				$0	
Telephone System	per call	$1	30000	$15,000	
($0.50 per call for 30,000)				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation	LS	$500	1	$500	
Subtotal Deployment					$15,500
Operations & Maintenance (per annum)					
Staffing					
Operations	hr.	$20	90	$1,800	
Maintenance	hr.	$30	10	$300	
O&M Equipment/Supplies/Materials	LS	$1,500	1	$1,500	
Subtotal O&M					$3,600
Grand Total					**$19,100**

COST ESTIMATE

ST-TI-9 — **AUTOMATED TRAVELER INPUT LOG AND DATABASE**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration				$0	
Planning					
Agency				$0	
Consultant				$0	
Subtotal Development					$0
Design					
Software Design	system	$13,000	1	$13,000	
Construction/Installation PS&E:				$0	
Subtotal Design					$13,000
Deployment					
Advertisement/Bid				$0	
Equipment Procurement Misc.				$0	
Signal Pre-emption Equipment		$1,200	10	$12,000	
Misc.		$200	10	$2,000	
				$0	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation	LS	$500	1	$500	
Subtotal Deployment					$14,500
Operations & Maintenance (per annum)					
Staffing					
Oberations	hr.	$30	55	$1,650	
Maintenance	hr.	$30	40	$1,200	
O&M Equipment/Supplies/Materials					
Subtotal O&M					$2,850
	Grand Total				$30,350

COST ESTIMATE

ST-TR-1 — **SIGN PRE-EMPTION FOR BUSES**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration	hr.	$30	100	$3,000	
Planning		$20	1000		
Agency	hr.			$20,000	
Consultant				$0	
Subtotal Deveiopment					**$23,000**
Design					
Software Design	hr.	$50	500	$25,000	
Construction/Installation PS&E:				$0	
Subtotal Design					**$25,000**
Deployment					
Advertisement/Bid				$0	
Equipment Procurement Misc.				$0	
Bus Equipment	per bus	$3,000	500	$1,500,000	
Corridor Equipment	per signal	$6,500	20	$130,000	
Signing/stripping	mile	$5,960	10	$59,600	
System integration	per signal	$5,000	20	$100,000	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation	LS	$15,000	1	$15,000	
Subtotal Deployment					$1,804,600
Operations & Maintenance (per annum)					
Staffing					
Operations	hr.	$30	2080	$62,400	
Maintenance	hr.	$30	1000	$30,000	
O&M Equipment/Supplies/Materials	Lump Sum	$70,000	1	$70,000	
Subtotal O&M					$162,400
Grand Total					**$2,015,000**

17,598 sq. ft. Thermoplastic pavement marking @$3.00 sq.feet = $53,000
Special sign + 6 x 6 timber = $40 each (40 signs = 1600)

COST ESTIMATE

ST-TR-2 AUTOMATIC VEHICLE LOCATION FOR LIGHT RAIL

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration	hr.	$30	100	$3,000	
Planning		$20	500		
Agency	hr.			$10,000	
Consultant				$0	
Subtotal Development					$13,000
Design					
Software Design	hr.	$50	200	$10,000	
Construction/Installation PS&E:				$0	
Subtotal Design					$10,000
Deployment					
Advertisement/Bid				$0	
Equipment Procurement Misc.				$0	
AVL Equipment	per vehicle	$29,000	23	$667,000	
Variable Message Signs	per stop	$35,000	3	$105,000	
System Integration	per signal	$3,000	20	$60,000	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation	LS	$15,000	1	$15,000	
Subtotal Deployment					$847,000
Operations & Maintenance (per annum)					
Staffing					
Operations	hr.	$30	2080	$62,400	
Maintenance	hr.	$30	500	$15,000	
O&M Equipment/Supplies/Materials	Lump Sum	$70,000	1	$70,000	
Subtotal O&M					$147,400
Grand Total					**$1,017,400**

COST ESTIMATE

ST-TR-3 — **MULTIMODAL TRANSFER CENTER**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration	hr.	$30	3000	$90,000	
Planning					
Agency	hr.	$20	8000	$160,000	
Consultant	study	$250,000	4	$1,000,000	
Subtotal Development					$1,250,000
Design					
Software Design	hr.	$150	1000	$150,000	
Construction/Installation PS&E:	LS	$400,000	4	$1,600,000	
Subtotal Design					$1,750,000
Deployment					
Advertisement/Bid				$0	
Equipment Procurement Misc.				$0	
Facility	each	$1,000,000	4	$4,000,000	
Hardware (Information)	each	$150,000	4	$600,000	
System integration	each	$30,000	4	$120,000	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation	LS	$50,000		$0	
Subtotal Deployment					$4,720,000
Operations & Maintenance (per annum)					
Staffing					
Operations	hr.	$30	2080	$62,400	
Maintenance	hr.	$30	900	$27,000	
O&M Equipment/Supplies/Materials	Lump Sum	$100,000	1	$100,000	
Subtotal O&M					$189,400
Grand Total					**$7,909,400**

COST ESTIMATE

ST-CM-1 BIG/LITTLE COTTONWOOD VARIABLE MESSAGE SIGN COMMUNICATIONS

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration	hr.	$30	20	$600	
Planning Agency Consultant				 $0 $0	
Subtotal Development					$600
Design					
Software Design	hr.	$50	20	$1,000	
Construction/Installation PS&E:				$0	
Subtotal Design					$1,000
Deployment					
Advertisement/Bid				$0	
Equipment Procurement Misc.				$0	
System integration (fiber optics partially installed; private/public partnerships assumed)	mile	$73,000	4.5	$328,500	
Variable Message Sign	each	$35,000	3	$105,000	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation				$0	
Subtotal Deployment					$433,500
Operations & Maintenance (per annum)					
Staffing Operations	hr.	$30	400	$12,000	
Maintenance	hr.	$30	100	$3,000	
O&M Equipment/Supplies/Materials					
Subtotal O&M					$85,000
Grand Total					**$520,100**

17,598 sq. ft. Thermoplastic pavement marking @$3.00 sq.feet = $53,000
Special sign + 6 x 6 timber = $40 each (40 signs = 1600)

COST ESTIMATE

ST-CM-2 PARLEY'S CANYON AND US 89 IN FARMINGTON INFORMATION AND INCIDENT MANAGEMENT

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration	hr.	$30	1000	$30,000	
Planning					
Agency		$20	700	$14,000	
Consultant		$100	2000	$200,000	
Subtotal Development					$244,000
Design					
Software Design	hr.	$150	200	$30,000	
Construction/Installation PS&E:	hr.	$150	1000	$150,000	
Subtotal Design					$180,000
Deployment					
Advertisement/Bid	LS	$10,000	1	$10,000	
Equipment Procurement Misc.				$0	
System integration (fiber optics partially installed; private/public partnerships assumed)	mile	$73,000	35	$2,555,000	
Variable Message Sign	each	$35,000	6	$210,000	
VMS System integration	each	$10,000	6	$60,000	
Accident Investigation Sites (asphalt pad)	each	$10,000	10	$100,000	
Call Boxes	each	$2,500	5	$12,500	
Incident Management Vehicles	each	$30,000	2	$60,000	
Global Positioning System Tie-in	unit	$8,000	6	$48,000	
Testing/Training/Start-Up/Evaluation	LS	$20,000	1	$20,000	
Subtotal Deployment					$3,075,500
Operations & Maintenance (per annum)					
Staffing					
Operations	hr.	$30	7280	$218,400	
Maintenance	hr.	$30	4160	$124,800	
O&M Equipment/Supplies/Materials	Lump Sum	$100,000	1	$100,000	
Subtotal O&M					$443,200
Grand Total					**$3,942,700**

Two Full-time staff for operations with one part-time maintenance crew for incident management
One full-time staff for call boxes and variable message sign operations.
Assume GPS is in place and coorinates have been set for the area.

COST ESTIMATE

ST-CM- **AVALANCHE SIGN AUTOMATION**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration				$0	
Planning					
Agency				$0	
Consultant				$0	
Subtotal Development					$0
Design					
Software Design	system	$4,000	1	$4,000	
Construction/Installation PS&E:				$0	
Subtotal Design					$4,000
Deployment					
Advertisement/Bid				$0	
Equipment Procurement Misc.				$0	
Upgrade communications equipment (laptop)	each	$6,000	1	$6,000	
Interface equipment		$10,000	1	$10,000	
				$0	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation				$0	
Subtotal Deployment					$16,000
Operations & Maintenance (per annum)					
Staffing					
Operations				$0	
Maintenance				$0	
O&M Equipment/Supplies/Materials				$0	
Subtotal O&M					$0
Grand Total					**$20.000**

COST ESTIMATE

ST-W-1 — **MOBILE PORT-OF-ENTRY STATIONS**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration	hr.	$30	40	$1,200	
Planning Agency Consultant	hr.	$20	40	$800 $0	
Subtotal Development					$2,000
Design					
Software Design	hr.	$150	40	$6,000	
Construction/Installation PS&E:				$0	
Subtotal Design					$6,000
Deployment					
Advertisement/Bid				$0	
Equipment Procurement Misc.				$0	
Pad with scale	each	$45,000	4	$180,000	
Facility (trailor)	each	$25,000	4	$100.000	
Hardware	system	$20,000	4	$80,000	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation	LS	$2,000	1	$2,000	
Subtotal Deployment					$362,000
Operations & Maintenance (per annum)					
Staffing Operations	hr.	$20	2080	$41,600	
Maintenance	hr.	$20	50	$1,000	
O&M Equipment/Supplies/Materials	LS	$2,000	1	$2,000	
Subtotal O&M					$44,600
Grand Total					$414,600

COST ESTIMATE

ST-W-2 — **AUTOMATED ENFORCEMENT STATIONS**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration	hr.	$30	20	$600	
Planning					
Agency	hr.	20	40	$800	
Consultant				$0	
Subtotal Development					$1,400
II Design					
Software Design	LS	$400,000	1	$400,000	
Construction/Installation PS&E:				$0	
Subtotal Design					$400,000
IDeployment					
Advertisement/Bid				$0	
Equipment Procurement Misc.				$0	
CCTV	each	$10,000	5	$50,000	
System integration	system	$10,000	5	$50,000	
				$0	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation				$0	
Subtotal Deployment					$100,000
Operations & Maintenance {per annum)					
Staffing					
Operations	hr.	$20	1040	$20,800	
Maintenance	hr.	$20	30	$600	
O&M Equipment/Supplies/Materials	LS	$4,000	1	$4,000	
Subtotal O&M					$25,400
Grand Total					$526,800

COST ESTIMATE

ST-W-3 — **COMMERCIAL VEHICLE ADMINISTRATIVE PROCESS**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration	hr.	$30	20	$600	
Planning					
Agency				$0	
Consultant				$0	
Subtotal Development					$600
Design					
Software Design	LS	$21,000	1	$21,000	
Construction/Installation PS&E:				$0	
Subtotal Design					$21,000
Deployment					
Advertisement/Bid	LS	$2,000	1	$2,000	
Equipment Procurement Misc.				$0	
Hardware	system	$5,000	1	$5,000	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation	LS	$2,000	1	$2,000	
Subtotal Deployment					$9,000
Operations & Maintenance (per annum)					
Staffing					
Operations				$0	
Maintenance				$0	
O&M Equipment/Supplies/Materials				$0	
Subtotal O&M					$0
Grand Total					**$30,600**

COST ESTIMATE

ST-RW-1 — **ROAD WEATHER INFORMATION SYSTEM**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration	hr.	$30	20	$600	
Planning					
Agency		$20	200	$4,000	
Consultant				$0	
Subtotal Development					$4,600
Design					
Software Design	system	$6,000	1	$6,000	
Construction/Installation PS&E:				$0	
Subtotal Design					$6,000
Deployment					
Advertisement/Bid				$0	
Equipment Procurement Misc.				$0	
Pavement Sensors	each	$15,000	7	$105,000	
Weather Sensors	each	$15,000	7	$105,000	
Communications	system	$10,000	7	$70,000	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Star&-Up/Evaluation	LS	$4,000	1	$4,000	
Subtotal Deployment					$284,000
Operations & Maintenance {per annum)					
Staffing					
Operations	hr.	$20	2080	$41,600	
Maintenance	hr.	$20	500	$10,000	
O & M Equipment/Supplies/Materials	L S	$4,000	1	$4,000	
Subtotal O&M					$55,600
Grand Total					$350,200

COST ESTIMATE

ST-RW-2 **SATELLITE WEATHER STATIONS**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration				$0	
Planning					
Agency	hr.	$20	120	$2,400	
Consultant				$0	
Subtotal Development					$2,400
Design					
Software Design	hr.	$100	40	$4,000	
Construction/Installation PS&E:	hr.	$30	40	$1,200	
Subtotal Design					$5,200
Deployment					
Advertisement/Bid				$0	
DTM Turnkey System-Dish/Communications	each	$2,500	20	$50,000	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation	LS	$2,000	1	$2,000	
Subtotal Deployment					$52,000
Operations & Maintenance (per annum)					
Staffing					
Operations	hr.	$20	1040	$20,800	
Turnkey Operations	mth.	$64	12	$768	
O&M Equipment/Supplies/Materials				$0	
Subtotal O&M					$21,568
Grand Total					$81,168

COST ESTIMATE

ST-RW3 **GLOBAL POSITIONING SYSTEM MAINTENANCE TRACKING**

Activity	Unit	Unit Cost	Quantity	Subtotal	Total
Project Development					
Management/Administration	hr.	$30	10	$300	
Planning					
Agency				$0	
Consultant				$0	
Subtotal Development					$300
Design					
Software Design	LS	$5,000	1	$5,000	
Construction/Installation PS&E:				$0	
Subtotal Design					**$5,000**
Deployment					
Advertisement/Bid				$0	
Equipment Procurement Misc.				$0	
Global Positioning System	each	$4,000	4	$16,000	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
				$0	
Testing/Training/Start-Up/Evaluation	LS	$1,000	1	$1,000	
Subtotal Deployment					$17,000
Operations & Maintenance annum)					
Staffing					
Operations				$0	
Turnkey Operations				$0	
O&M Equipment/Supplies/Materials				$0	
Subtotal O&M					$0
Grand Total					**$22,300**